PUTNAM END MILLS
for ROUGHING CUTS *in* HIGH CHROME STEEL

When you want an end mill that will dig right in and really remove stock, use a Putnam Hi-Speed End Mill. This photograph shows a one inch Putnam End Mill roughing out a slot almost one-half inch deep in a vital armament part made of high chrome steel. Putnam End Mills, when used for roughing, remove maximum stock in minimum time. For heavy roughing cuts . . . for high speed finish milling, Putnam End Mills deliver outstanding performance. No matter what the job, a Putnam End Mill will cut faster and last longer.

PUTNAM TOOL COMPANY

2985 Charlevoix Ave. Detroit, Michigan

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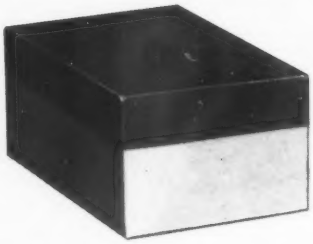
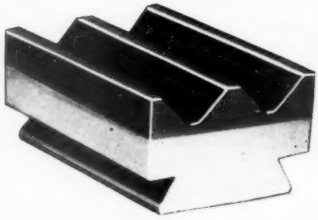
NEW WAY TO CONSERVE HIGH SPEED STEEL





Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks *(high speed steel cutting face; mild steel base)* save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—

1. Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.

2. Easier to drill and tap screw holes and machine dovetails in mild steel base; this work may be done *after* hardening if desired.

3. More prompt delivery because of reduced amount of high speed steel.

4. Inseparable bond between cutting face and base assured by special technique of electric welding.

5. *Marked saving of strategically important tungsten.*

Special Bulletin contains full particulars and prices.
Write for your copy of Bulletin TJ today.

QUALITY FCC SERVICE

THE FORGING and CASTING CORPORATION

FERNDALE (DETROIT) MICHIGAN

HARDINGE PRECISION LATHES

- Extreme Accuracy
- High Spindle Speeds
- Ease of Operation

HARDINGE Precision Lathes combine these three important requisites for production:

Extreme Accuracy **for the close tolerances demanded by today's rigid manufacturing standards.**

High Spindle Speeds **mean greater production and a better finish.**

Ease of Operation **enables relatively unskilled operators to produce parts to the necessary close limits without expensive tooling.**

SPECIFICATIONS: 1" collet capacity, 6" step chuck capacity, 5" jaw chuck capacity, 9" swing, 36" bed, lever speed control with spindle brake, 8 speeds forward and 8 speeds reverse from 230 to 3900 R.P.M.

"Performance has established leadership for **HARDINGE"**

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HARDINGE BROTHERS INC., ELMIRA, N.Y., U.S.A.

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GEORGE J. HUEBNER • EDITOR, PUBLISHER

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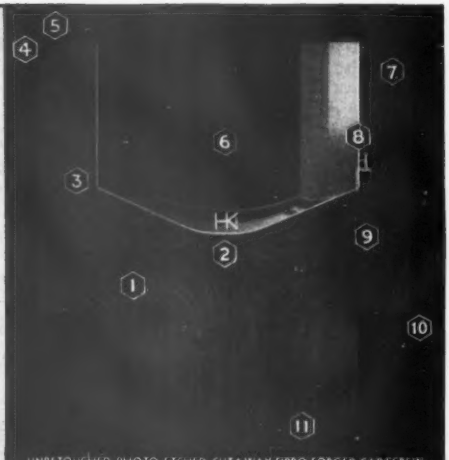

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1. INCREASED STRENGTH.
2. CONTINUOUS UNCUT LATERALLY DEFLECTED CORE FIBRES.
3. CONTINUOUS UNBROKEN FIBRES.
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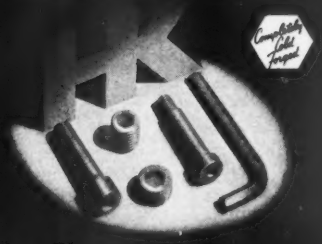
9. CONTINUOUS UNCUT FIBRES.
10. SQUARE SHOULDERS.
11. ORIGINAL CONTINUOUS FIBROUS STRUCTURE.

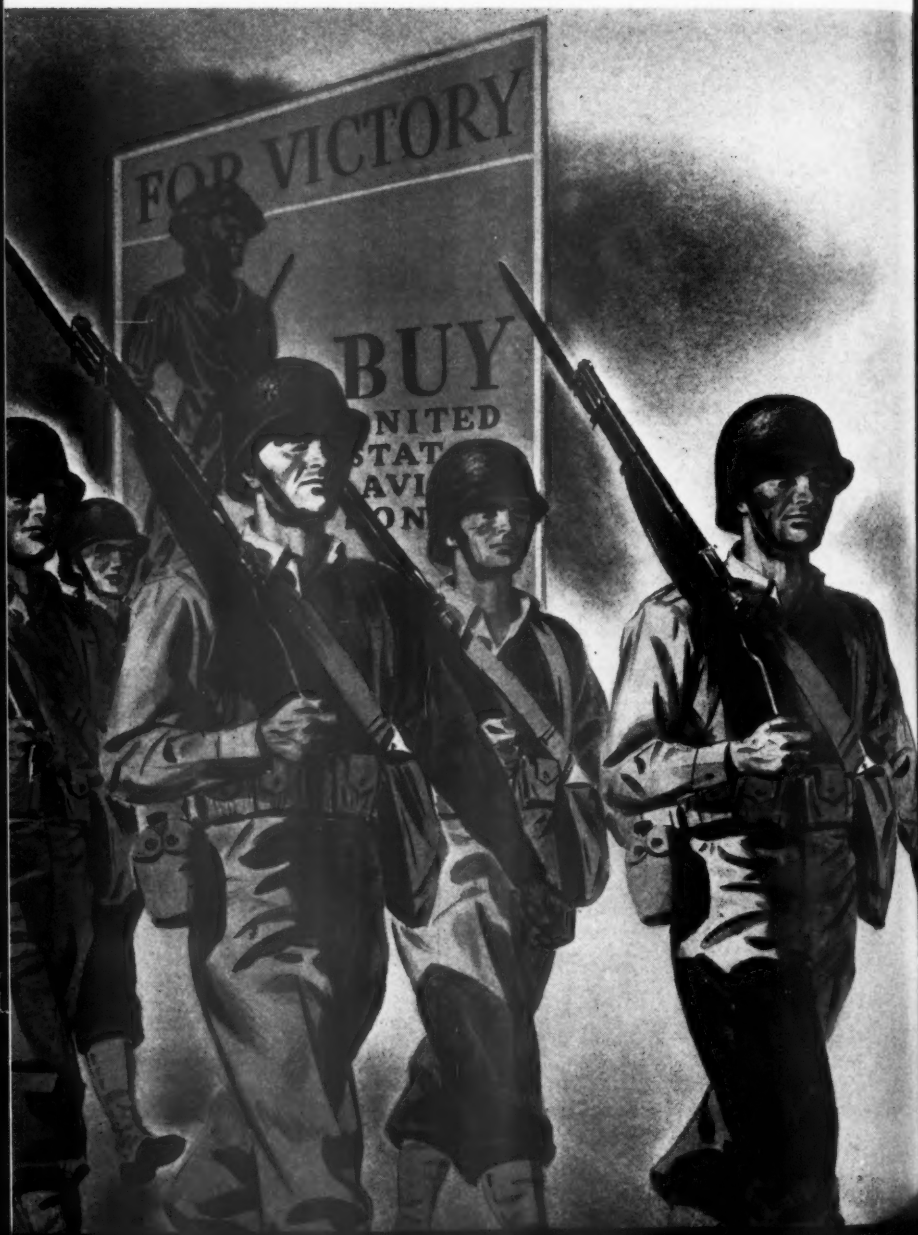


THE RESULTS OF A SUPERIOR METHOD, PATENTED, EXCLUSIVELY USED BY HOLO-KROME

HOLO-KROME *fibro forged* SOCKET SCREWS

THE HOLO-KROME SCREW CORP.
HARTFORD, CONN., U.S.A.

For your Country...



...for Yourself

BUY U. S. WAR BONDS

ONLY 1 out of 20 Americans will be called to active duty—to face hardship, injury, even death. The rest of us are needed here. We can't *all go*—but we can *all help.*

Planes, tanks, ships, guns and ammunition don't just grow. They cost money—lots of money.

To help pay for these materials of war, your Government is asking you—not to *give*—merely to *loan* your money by buying War Bonds. You will receive a good rate of interest, since every three dollars invested in War Bonds will return four dollars to you at the end of ten years. Meanwhile, your money will help supply the fighting equipment without which Victory is impossible. For example, three dollars' worth of War Bonds enables the Government to buy 144 rifle bullets. Millions and millions of these bullets are needed, together with the equipment that will make these bullets effective.

For your country—for yourself—

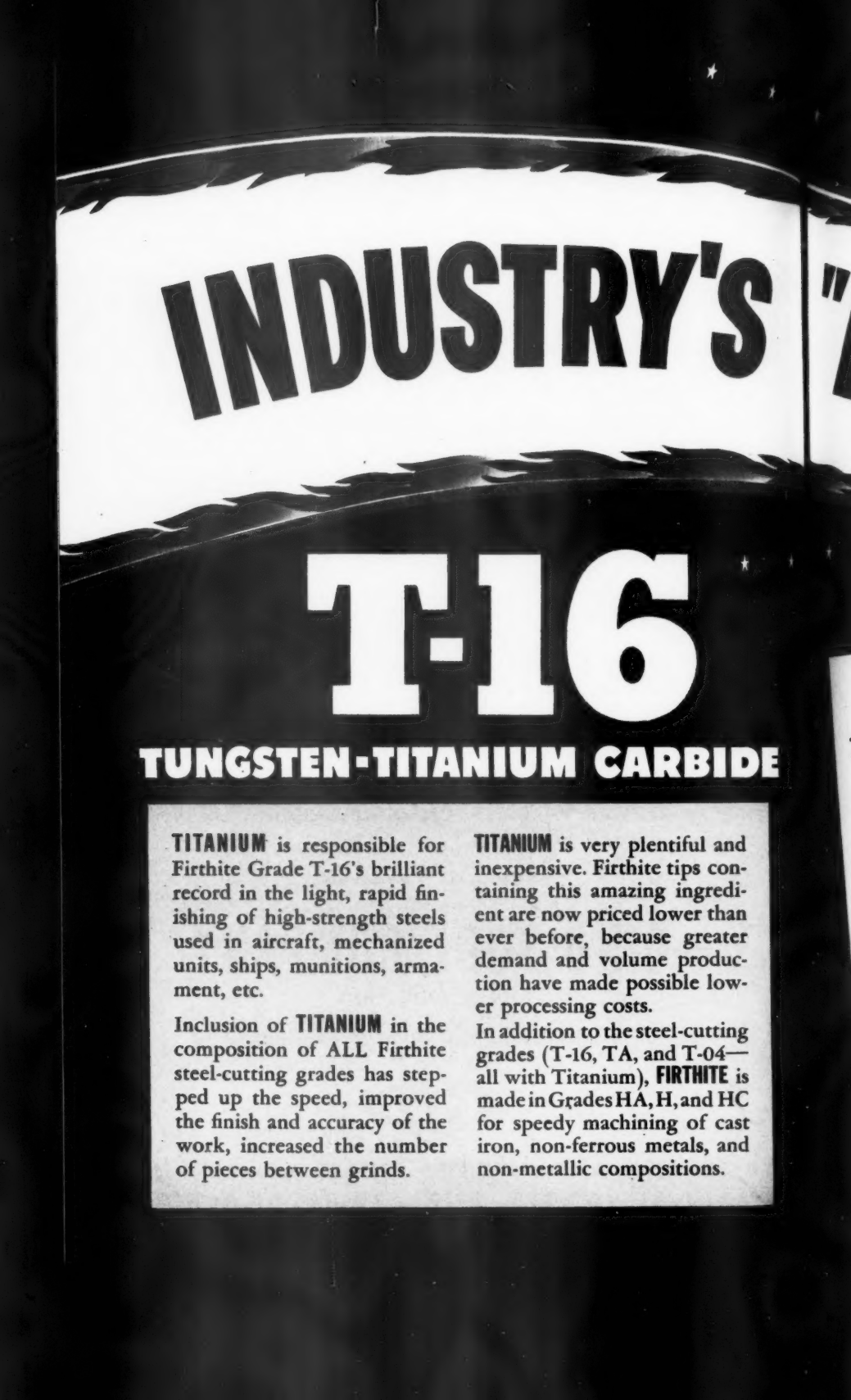
Buy U. S. War Bonds

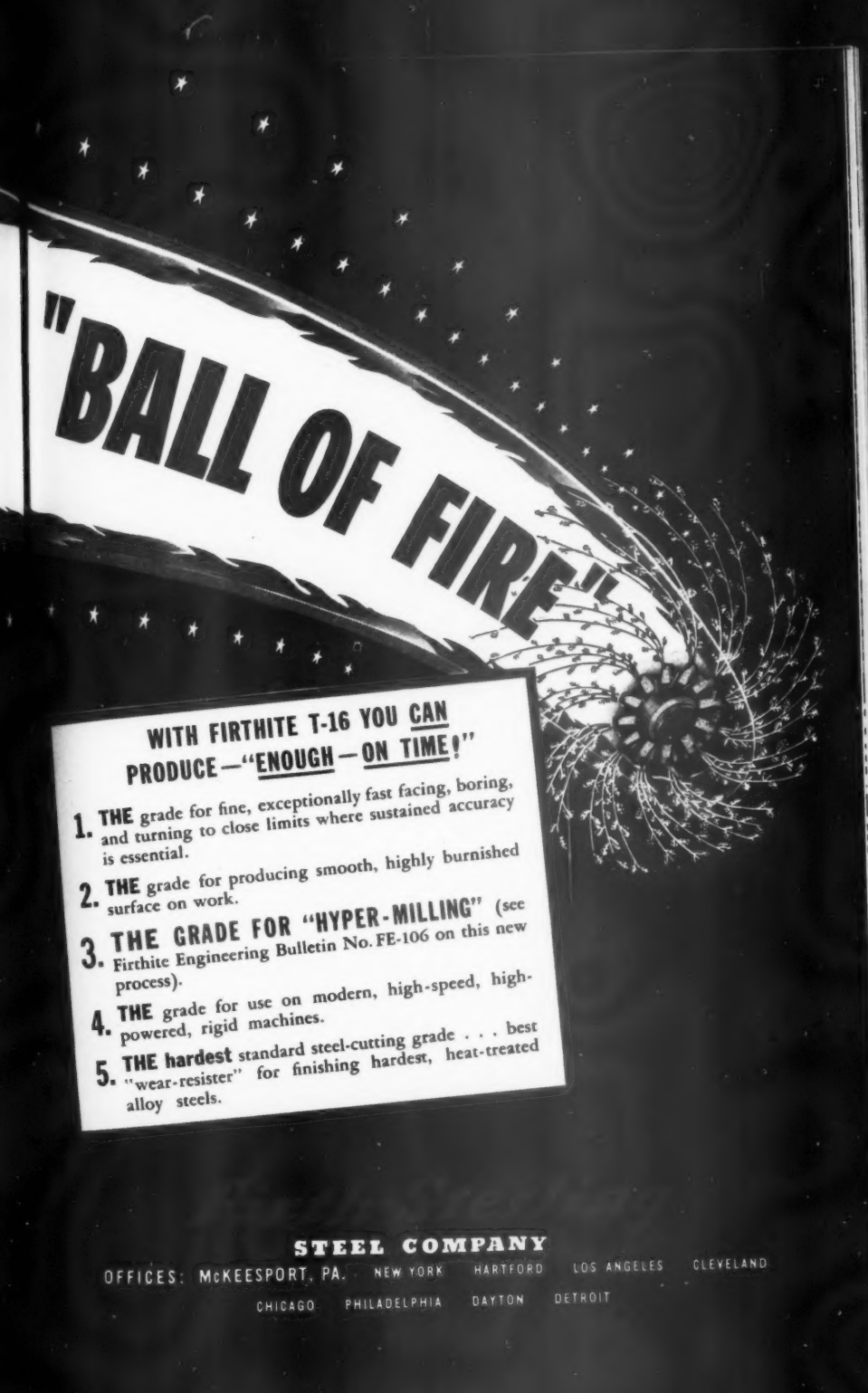
OHIO TOOL COMPANY

CLEVELAND, OHIO

Manufacturers of Small Arms Ammunition Tools

DESIGNERS AND BUILDERS OF TOOLS, DIES, JIGS, FIXTURES, GAGES AND SPECIAL MACHINERY


INDUSTRY'S
T-16
TUNGSTEN-TITANIUM CARBIDE
TITANIUM is responsible for Firthite Grade T-16's brilliant record in the light, rapid finishing of high-strength steels used in aircraft, mechanized units, ships, munitions, armament, etc.
Inclusion of TITANIUM in the composition of ALL Firthite steel-cutting grades has stepped up the speed, improved the finish and accuracy of the work, increased the number of pieces between grinds.
TITANIUM is very plentiful and inexpensive. Firthite tips containing this amazing ingredient are now priced lower than ever before, because greater demand and volume production have made possible lower processing costs.
In addition to the steel-cutting grades (T-16, TA, and T-04—all with Titanium), FIRTHITE is made in Grades HA, H, and HC for speedy machining of cast iron, non-ferrous metals, and non-metallic compositions.



WITH FIRTHITE T-16 YOU CAN PRODUCE—"ENOUGH—ON TIME!"

1. **THE** grade for fine, exceptionally fast facing, boring, and turning to close limits where sustained accuracy is essential.
2. **THE** grade for producing smooth, highly burnished surface on work.
3. **THE GRADE FOR "HYPER-MILLING"** (see Firthite Engineering Bulletin No. FE-106 on this new process).
4. **THE** grade for use on modern, high-speed, high-powered, rigid machines.
5. **THE hardest** standard steel-cutting grade . . . best "wear-resister" for finishing hardest, heat-treated alloy steels.

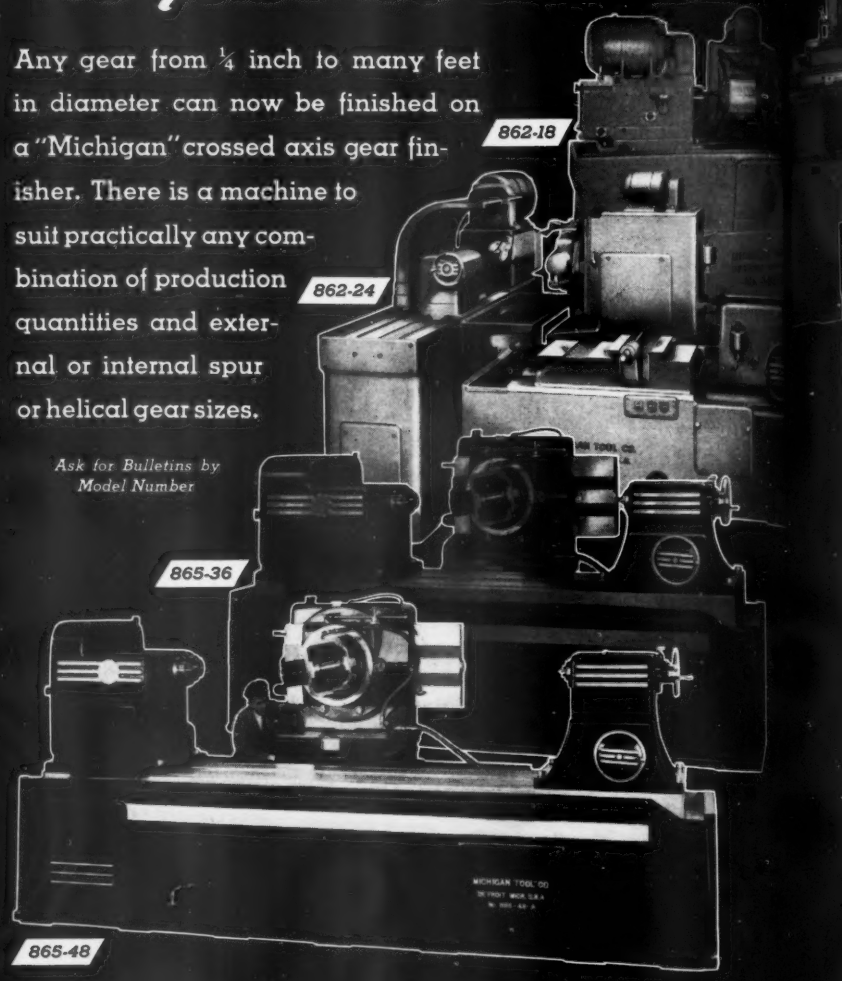
STEEL COMPANY

OFFICES: McKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT

No gear too large..... No gear too small...

Any gear from ¼ inch to many feet in diameter can now be finished on a "Michigan" crossed axis gear finisher. There is a machine to suit practically any combination of production quantities and external or internal spur or helical gear sizes.

Ask for Bulletins by Model Number



MACHINE MODEL NO.	GEAR CAPACITY (diameter)
861-4B (Light Duty)	¼" to 4"
900 (Rack Type)	1" to 8"
860-(A or B)-8	1" to 8"
860-(A or B)-12	1" to 12"
860-(A or B)-16	1" to 16"
862-18 (Heavy Duty)	2¼" to 18"
862-24 (Heavy Duty)	2¼" to 24"
865-36 (Heavy Duty)	4" to 36"
865-48 (Heavy Duty)	4" to 48"
865-??? (Heavy Duty)	for larger gear sizes up to 16 feet diameter (on special order)

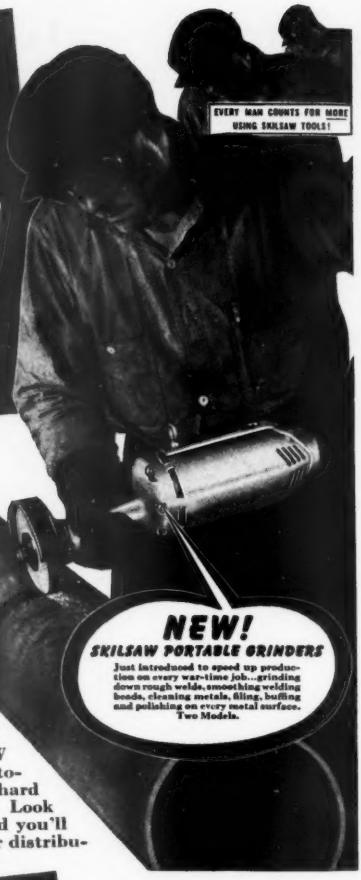
MICHIGAN TOOL COMPANY

7171 E. McNichols Road Detroit, U.S.A.

Grind Quicker... Grind Smoother

ON EVERY WAR-TIME JOB WITH THESE

SKILSAW TOOLS!


EVERY MAN COUNTS FOR MORE USING SKILSAW TOOLS!
NEW!
SKILSAW PORTABLE GRINDERS
Just introduced to speed up production on every war-time job...grinding down rough welds, smoothing welding beads, cleaning metals, filing, buffing and polishing on every metal surface. Two Models.

• Here are FIVE kinds of SKILSAW TOOLS you shouldn't be without, if you want to *speed* your finishing operations, *reduce* waste and *increase* your output in war production. Do you have welds to grind down? Stainless steel or brass sheets to polish? Castings to clean? Small machine parts to finish? There's a SKILSAW TOOL for each of these operations . . . and the job will get done quicker and better and at lower cost.

These SKILSAW GRINDERS and SANDERS are typical of the entire line of SKILSAW TOOLS—designed to deliver results under today's stepped-up conditions, built to stand hard usage without time-wasting breakdowns. Look into America's busiest war-work plants and you'll see SKILSAW TOOLS on the job. Ask your distributor for a demonstration and you'll see why!

SKILSAW PORTABLE ELECTRIC **TOOLS**

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

Sold by leading distributors of mill and welding supplies.

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Sanding stainless steel to a perfect finish is faster with SKILSAW Disc Sanders. Also remove waste metal, buff and polish on all surfaces.

SKILSAW Belt Sanders speed up all "final-finishing" on flat surfaces of bronze, brass and all sheet metals. Remove paint.

SKILSAW Hand Grinders are swifter, better on all grinding of jigs, dies and for precise finishing on machines and castings.

Spotted conveniently throughout the plant, SKILSAW Bench Grinders speed production, keep tools and twist drills sharp, grind small parts.

EVERY TOOL STEEL HAS AN ALTERNATE

. . it pays to know them

AS war production rises rapidly toward its peak, the problem of *materials* becomes more and more insistent.

High Speed Steels furnish one of the best examples, because these special steels depend for their properties on some of the most critical alloying elements in the list. Continuity of supply of High Speed Steel is absolutely essential to continuity of production; yet, under the exigencies of equable distribution, you may encounter a temporary shortness of supply in your first-choice cutting steels at any given time.

It would be wise to protect yourself against such an eventuality. Take precautions against a loss of production time and volume by learning the *alternate* tool steels for your jobs. Get familiar with them—just what they'll do and how they're handled. Frequently the alternate can step into the job with no loss of performance; in a great many cases, a steel can be found that will out-perform the original. ● But play safe—know the alternate tool steels for the types you customarily use. Our Engineering Staff is at your service.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

SAVE TIME AND MONEY THESE 5 DIFFERENT WAYS

This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1 Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.

2 Saves time and expense of drawing or tempering small metal parts in large furnaces.

3 Cuts handling time when normalizing or annealing small parts. No waiting.

4 Conveniently available for pre-heating for subsequent high-speed hardening.

5 Eliminates shut downs and delays in servicing emergency repair orders.

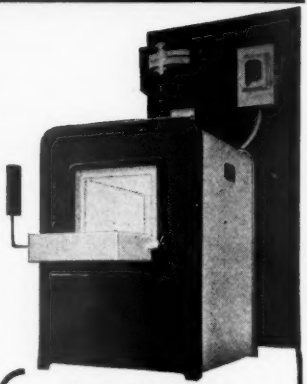
AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$124.00*
MH-4	10″W 6″H 18″L	.....	4800	20.9	$191.00*

**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$142.40.



REPLACEABLE HEATING ELEMENTS

Replaceable nickel chromium resistors embedded in rectangular refractory blocks. Elements form inner walls of furnace chamber, and may be replaced easily and quickly after removing rear panel — furnace structure remains undisturbed.

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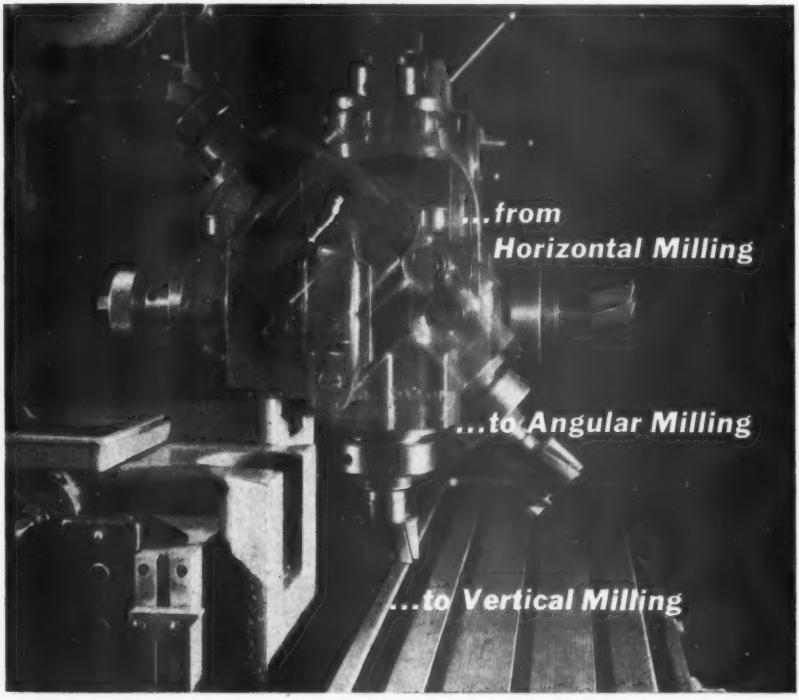
Quick Changes on Van Norman

RAM-TYPE MILLING MACHINES



When the operator has completed a horizontal cut on a Van Norman Ram-Type Miller, and wishes to proceed to an angular or vertical cut . . . *he does not need to touch the set-up on the table.* All he has to do is unclamp the swiveling cutterhead, swing it to the required position, reclamp . . *and start the next cut.* Only a matter of moments, compared with the time needed to reset the work. And one of the greatest sources of errors is completely avoided. This exceptional ease and convenience of operation provide gains in time, accuracy and output. So today, throughout America's war industries, Van Norman Ram-Type Millers are delivering the goods in great plenty . . . and in plenty of time.

VAN NORMAN
Machine Tool Company
SPRINGFIELD, MASSACHUSETTS

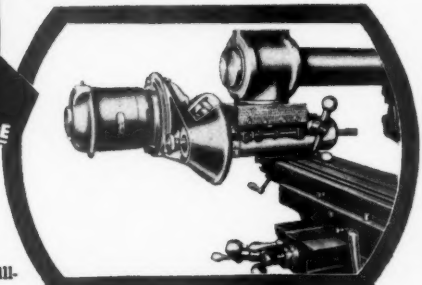
In June, 1942, Van Norman was awarded the Army and Navy E in recognition of its war production record

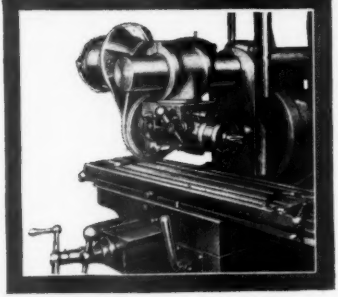
New HALCO UNIVERSAL HEAD

for High Speed MILLING, DRILLING, BORING and COUNTER BORING

Five Speeds 350 to 2900 R.P.M. Also 10 speeds 125 to 2900 R.P.M. available at extra cost.

FOR HIGH SPEED MILLING, DRILLING, BORING AND COUNTER BORING ON ANY ANGLE





THE Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advantage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

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(Designers and Builders of Fine Machine Tools)

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AJAX ENGINEERING & MFG. CO.

MANUFACTURERS OF HALCO PRODUCTS

14230 BIRWOOD AVE., DETROIT, MICH.

WHY WAIT WEEKS FOR TOOLS or PARTS?

Make them the Same Day on a

DoAll

25 different parts of this Automatic Paper File Folding Machine are now made on the DoAll—and without blueprints.

All external and internal shape cutting in making these special parts and molds was done on the DoAll.

A large airplane plant makes these Propeller Wrenches on the DoAll.

READ THIS BOOK—Send for a copy of "DoAll on Production", a picture story of this little giant of industry.

● In addition to doing a fine job in regular production work, the DoAll is the 100% patriot today to which you can turn in emergencies.

Don't tie up vital machines for weeks waiting for replacement parts from the factory. Make them on the DoAll—the fastest precision method for external and internal cutting without waste of all kinds of metals, alloys, plastics, wood, etc. Finished jobs are ready for use—further machining is not necessary.

The DoAll also makes special tools and dies, following a hairline layout in shortest possible time. Short runs of metal products can be handled on the DoAll, relieving heavier, higher-priced machine tools for other work. Sheet metal or alloy can be stacked and 20 to 80 parts cut out at one time.

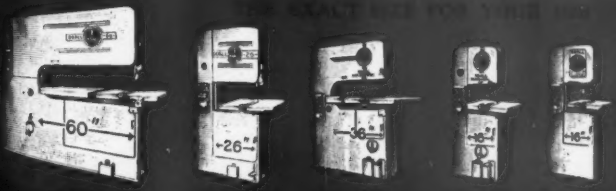
ASK FOR DEMONSTRATION

A factory-trained man will call with a DoAll and show you its production versatility, economy and time-saving features.

CONTINENTAL MACHINES, INC.

1303 S. Washington Ave. Minneapolis, Minn.

Associated with the DoAll Company, Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines.



Sommer & Adams offers you upwards of 25 years' experience in the design of special machinery. Your individual requirements will receive our best attention.

Special Delivery FROM SOMMER & ADAMS

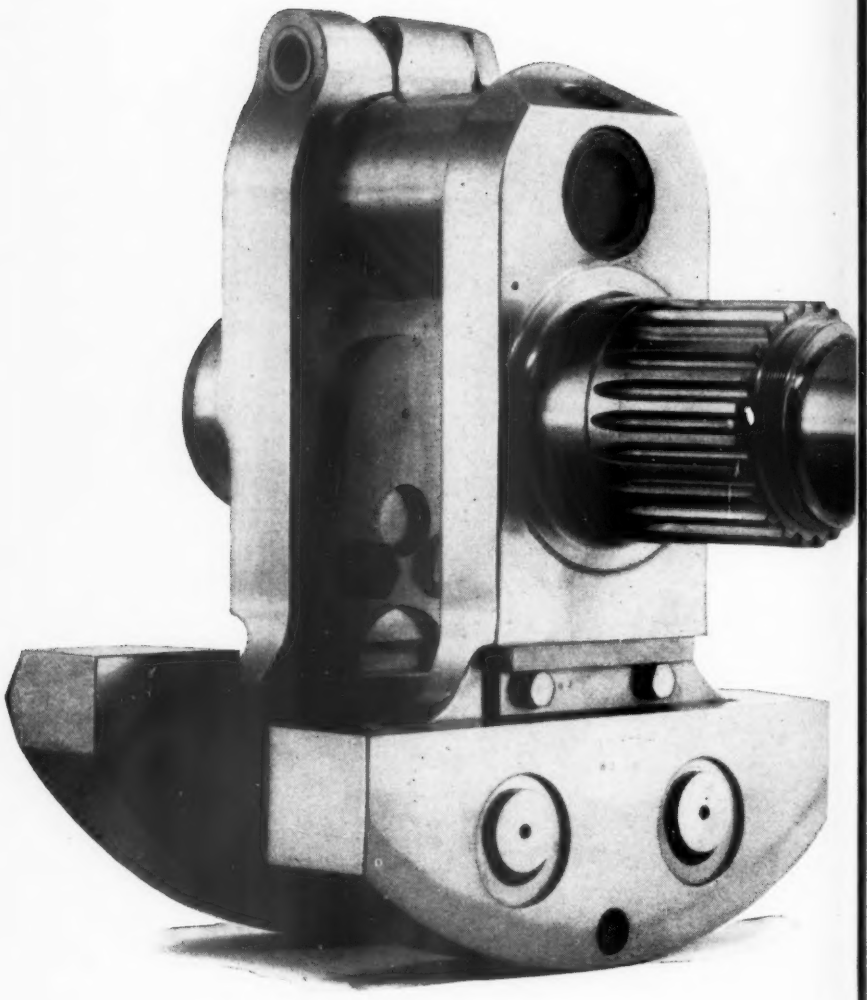
THE huge machine you see above is 14 feet long, 5 feet wide, and 6-1/2 feet high. *From end to end, it was a special job.* Its purpose is to mill the thread on the breech blocks of 90-millimeter guns. It is the hope of the Sommer & Adams organization that the results which will be achieved from the use of this equipment may contribute in some small degree to ultimate victory.

Resolve to invest at least 10 percent of your income in your country's future. Buy war bonds

THE SOMMER & ADAMS COMPANY

18511 EUCLID AVENUE · CLEVELAND, OHIO

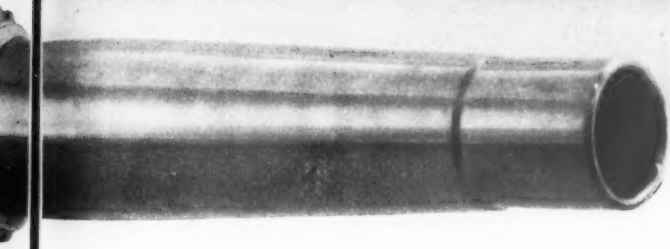
Custom-Built EQUIPMENT FOR MANY PURPOSES



THE CARBORUNDUM

REG. U. S. PAT. OFF.

What's the most important half second in the life of a crankshaft?



YOU'RE looking at one of the sweetest pieces of precision engineering that ever stirred a craftsman's heart. Accurate as the balance wheel of your watch, this airplane engine crankshaft will soon be helping some pilot show the enemy what American men and machines can do.

However, in the split-second in which the final grinding operation on the shaft was completed, had the operator taken off just 0.001 inch more than the minimum diameter specified for the bearing, for instance, the shaft would never have seen action at all. Its value would have been reduced to scrap. And the staggering total of man and machine hours which had gone into it up to that point would have been worth absolutely nothing.

Can you find a single operation in war production where so much is at stake as in the final grinding process? Because of the key role it plays in war output, the grinding operation is one of the first places to check for ways to conserve materials, effort and time.

Make certain that your grinding machines are being operated with the utmost possible care. Make certain too that you are using the right grinding wheel for the particular job at hand. It is a *Weapon of Production* and should be properly used for maximum effectiveness.

Manufacturer's recommendations should be carefully followed on wheel speed, work speed, rate of infeed, wheel traverse, proper coolant and wheel grading (grit, grade and bond). Only the correct balance of these several factors will insure maximum production.

You are cordially invited to visit us at Booth C-122
National Metal Congress Exposition
Cleveland Auditorium, October 12-16.

COMPANY, NIAGARA FALLS, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

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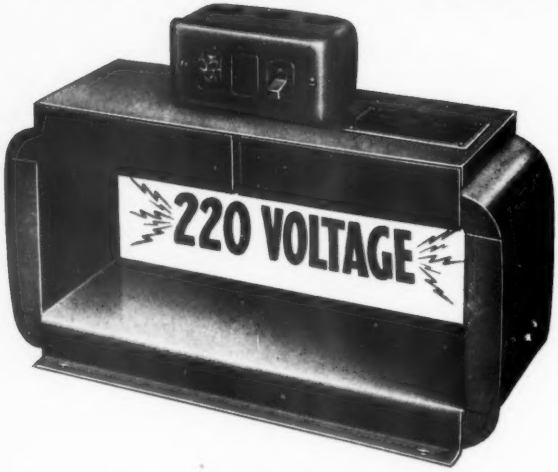
Welch

QUICK DEMAGNETIZER

Operates on **220 VOLTAGE** A. C. 60 Cycle



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INSIDE MEASUREMENTS APPROXIMATELY 4″x11″

•

A REMARKABLE TIME SAVER

AN outstanding unit needed wherever magnetic chucks are used. Operates on 220 voltage. Any ordinary sized pieces, such as cutters, gears, washers, etc., can be demagnetized by a single pass through its powerful field. Can be easily connected by your own electrician in any convenient location in your plant. Equipped with convenient switch. (If your power is other than 220 volt, 60 cycle, A.C., kindly let us know.) Carried in stock for immediate delivery. 10 DAYS FREE TRIAL IF DESIRED.

Price $120.00

Write for particulars

Welch INDUSTRIES, INCORPORATED

Makers of High Speed Milling Cutters — Form Tools and Special Tools

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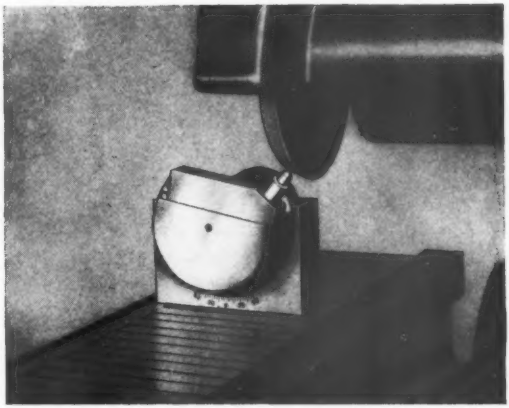
Welch

QUICK ANGLE DRESSER



AS suggested by its name, the Welch Quick Angle Dresser can be set quickly for dressing the grinding wheel to any desired angle. It is small, compact, durable; simple in design and construction. All surfaces are hardened and ground. Furnished in plain or Vernier type. Plain dresser graduated in degrees .... Vernier reads in degrees and minutes. The Vernier being an integral part of the base block eliminates any possibility of error. 10 DAYS FREE TRIAL IF DESIRED.

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One Diamond is Furnished with Each Dresser

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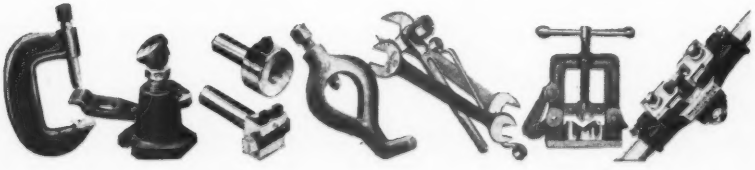

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And only with the CENTER SCOPE is *Accuracy so Simple!*

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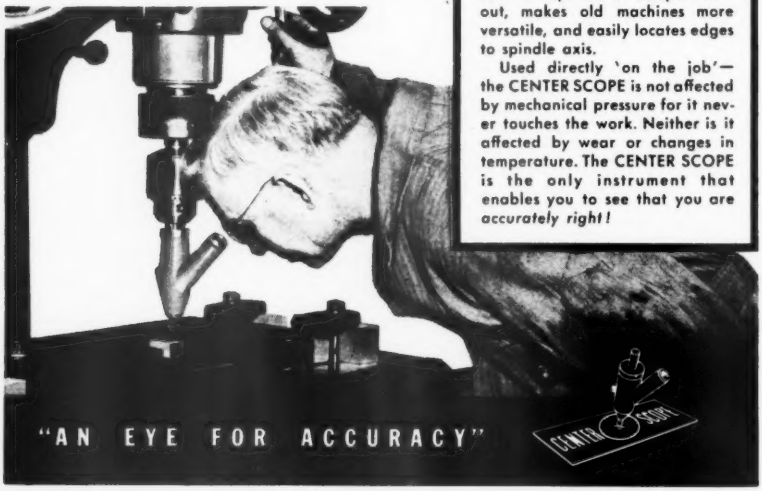

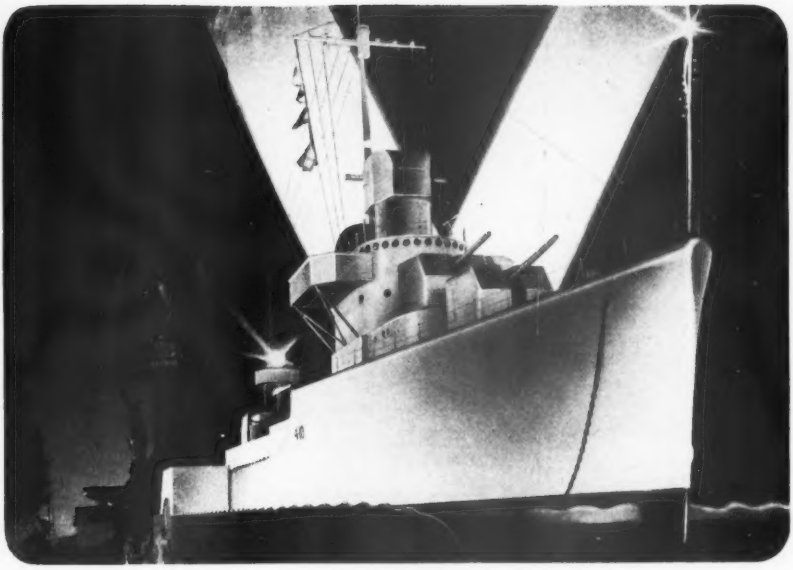

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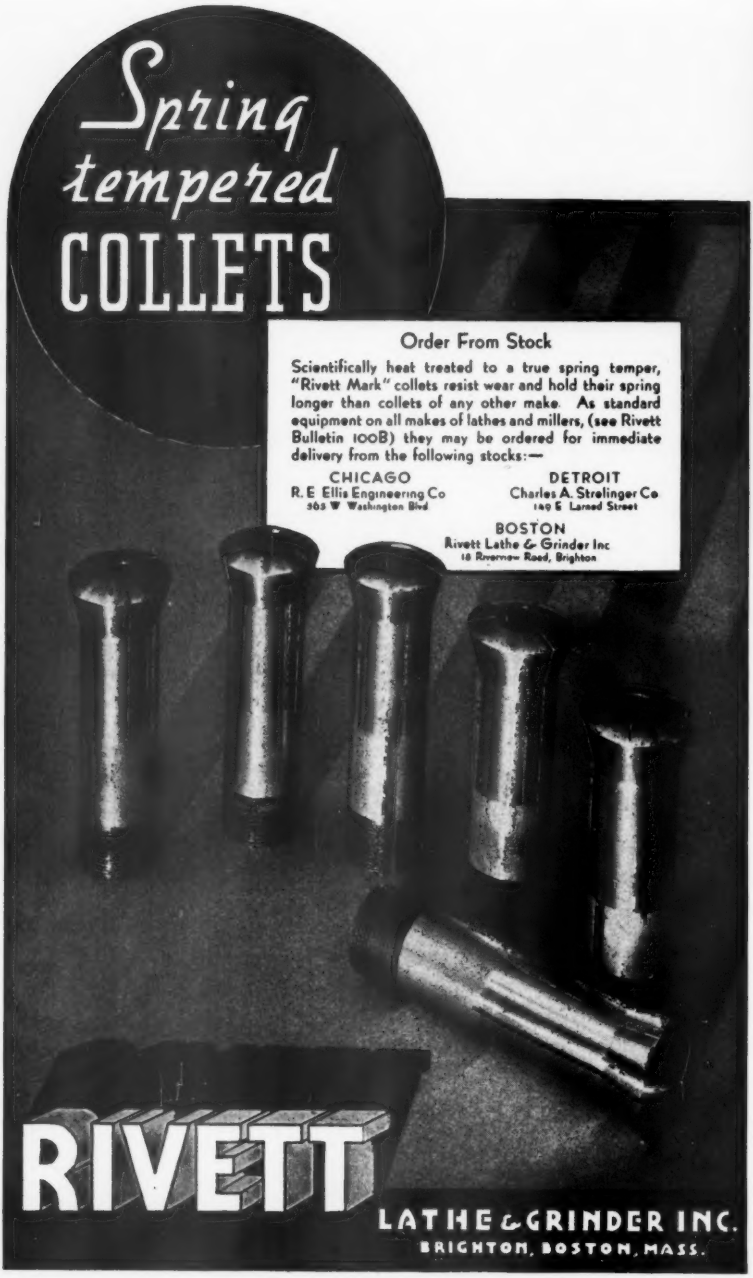
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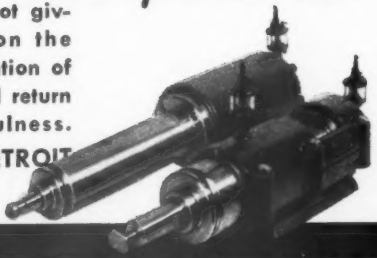

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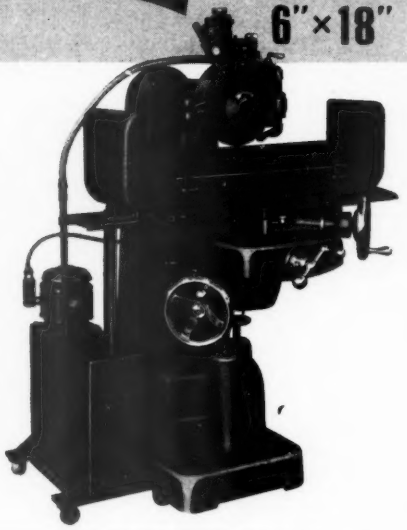

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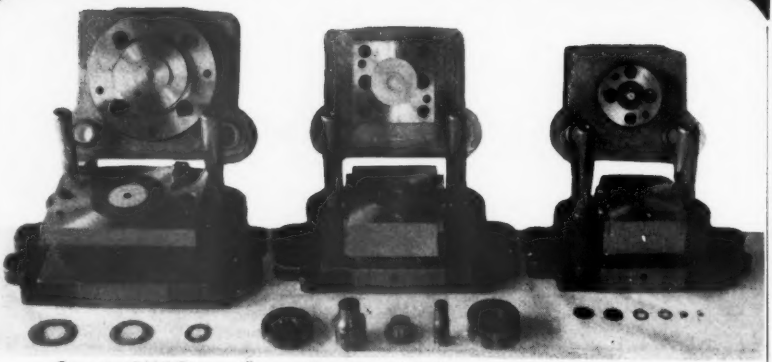

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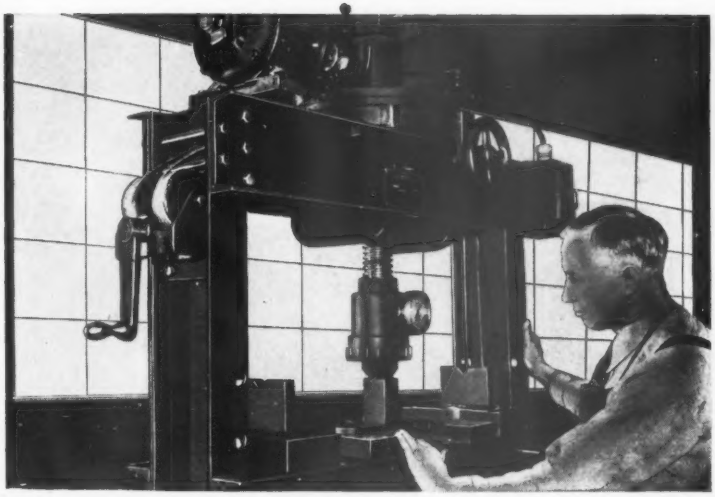

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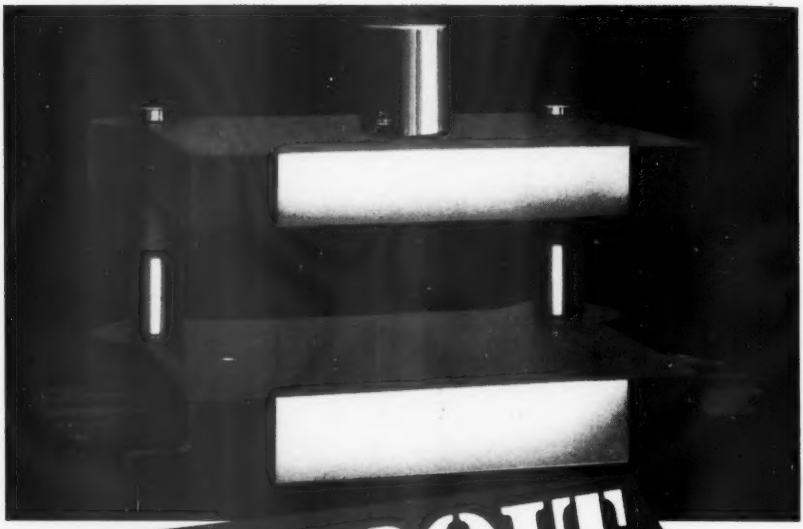

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STANDARD DIE SETS in stock for immediate shipment.

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Delta Design Always Offers These Advantages:

Low First Cost • Low Maintenance Cost • Economical Operations • Reduced Labor Costs • Greater Flexibility • Portability

The complete DELTA-Milwaukee line consists of low-cost, high-quality Drill Presses, Cut-Off Machines, Grinders, Abrasive Finishing Machines, Saws, Lathes, Jointers and Shapers.

SEND FOR FREE *"TOOLING TIPS"*

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IN many of America's leading munitions plants, the mere adoption of TECO Carbide Dies has made a substantial increase in out-put. These long-wearing dies get maximum production from machines by holding all on-size longer, providing a smoother finish and eliminating rejects.

TECO Carbide Dies—made to rigidly controlled standards of uniformity, density and hardness—are turning out millions of cartridge cases weekly . . . . speeding up production in every operation, through drawing, sizing, tapering, necking and swaging. They will do the same for your plant. Investigate today. Then try a test run to let TECO Carbide Dies prove themselves.

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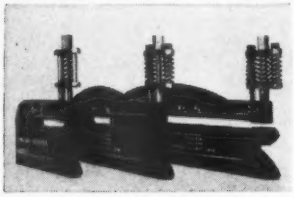
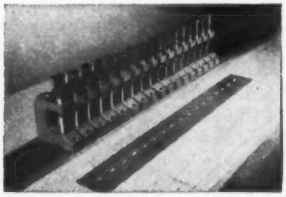
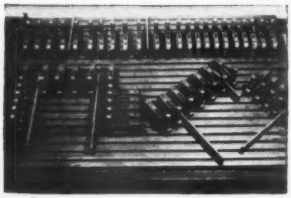


Above shows Wales "Selective Strippers" of 1, 2, and 3 interchangeable springs to provide the exact stripping action required for each job.



Gang of Wales Units on brake press rail.



Showing 3 set-ups of Wales Units on one T-slotted plate.

CERTAINLY — moving into a new, larger plant provides increased production and faster deliveries of Wales Punching and Notching Units to today's essential metal fabricating industries.

AND—when Victory comes, The Strippit Corporation will be ready with new ideas . . . new short cuts . . . new economies . . . new techniques . . . and NEW WALES PRODUCTS for your competitive peace-time conditions.

REMEMBER—There's Always Something New in the Wales Line. Keep posted by writing to—

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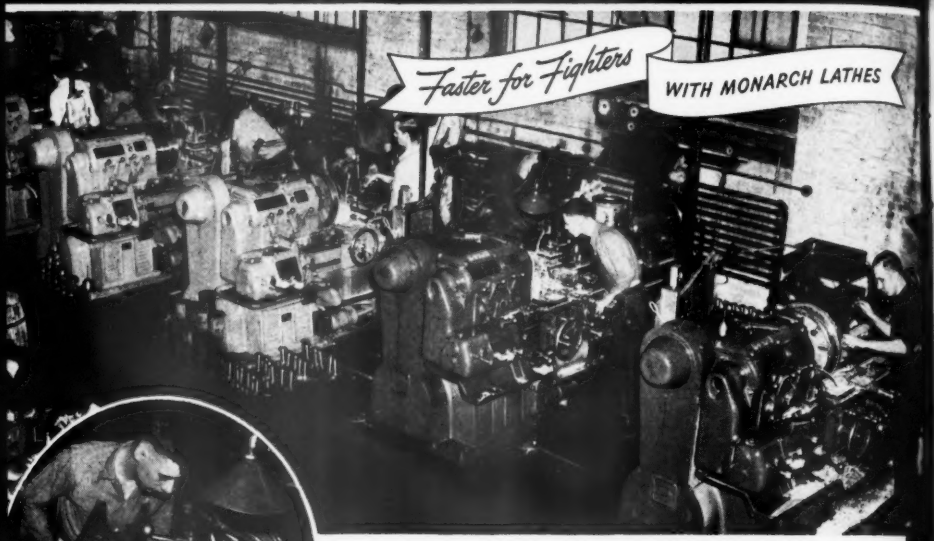
Specialists in Punching and Notching Equipment

***North Tonawanda is 10 Miles North of Buffalo between Buffalo and Niagara Falls**

Precious minutes saved!



Unit saving and production increase of dogs for armored doors are multiplied by this battery of Monarch lathes.

Taking advantage of the versatility of Monarch lathes, this producer of dogs for armored doors and hatches on conning towers has reduced machining time to less than one-half the former schedule.

About half the previous time was devoted to facing and counterboring—now accomplished more than twice as fast on a Monarch lathe. Facing the dogging surface absorbed the other half of the finishing time—now done on a Monarch with an interrupted cut in 60% of the previous time. Thus Monarch does both jobs in less time than previously was required for either one.

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Today, when every production minute saved is precious, and when every machine tool is so urgently needed, this example will help other plants produce faster for fighters.

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DEVELOPS A QUICKER WAY TO DO THE JOB

A milling department leadman in a big aeronautical plant, William Van Way, has worked out this simpler, cheaper, entirely adequate Fixture for holding hollow impeller drive shafts. Sketch shows details. Only a few simple items are needed. An angle support has a tongue, fitting in the table slot. A bushing on the vertical leg centers the shaft, which is held by a long bolt through the shaft and bushing. The depth of the milling cutter is set by a thickness gauge from top of fixture. This effective device replaces the previous expensive set-up, reduces loading and unloading time to minimum.

TIME REDUCED 50%

USING A GORTON

SUPER-SPEED VERTICAL MILLING MACHINE

with a Simpler, Faster Set-Up

MILLING ACCURATE KEYWAYS on airplane engine impeller drive shafts is done on a Gorton 9-J Miller in half the former time (6.3 minutes per piece floor to floor), holding a tolerance of ±.001".

The keyway is .188" wide x .440" long, having a .020" radius in the bottom corners. A two-flute end mill is run at 2800 r.p.m. This continuous high speed is made possible on the Gorton Super-Speed Vertical Miller because it has precision pre-loaded bearings, perfect balance, and rigid design. After each fifty pieces, the cutter is re-sharpened on the Gorton 375-2 Cutter Grinder, which not only resharpens the cutter flutes, but forms the .020" radius as well.

This is but one of many examples of how Gorton Super-Speed Millers and Gorton Cutter Grinders save vital hours of machining in aircraft and other plants producing war equipment. Perhaps our engineers can assist you in saving additional time on your high-speed milling. We will be glad to make recommendations — no obligation.

SUPER-SPEED MILLING DATA

OPERATION—Mill Key Slot .188" wide x .440" long, .020" radius in corners.

MACHINE—Gorton 9-J Super-Speed Vertical Miller.

PART—Gear Impeller Drive Shaft.

CUTTER—2-Flute, High-Speed Steel End Mill.

HOLDING—Simple Special Fixture as illustrated.

FEED—Hand.

SPINDLE SPEED—2800 r.p.m.

FLOOR-TO-FLOOR TIME—6.3 minutes.

FREE

Write for your copy of Bulletin 1400-B covering Gorton Super-Speed Vertical Milling Machines. It explains their 8 exclusive advantages for handling work faster and cheaper. Used for milling dies, molds, and miscellaneous or production work.

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SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

THE TOOL & DIE JOURNAL

OCTOBER, 1942 VOLUME 8, NUMBER 7

■

Letter from Washington
by George J. Huebner

"Workers Who Cannot Be Replaced"

MANPOWER is the topic of the day. The Armed Forces need men to train. Industry needs its trained men. The competition between these groups is not an equal one, the Selective Service having the authority to order induction.

Among the so-called "necessary" men of industry none is more urgently needed in his place than the tool maker, the die maker and the gage maker. That this is recognized, at least partially, is evidenced by a list of 13 vital occupations of "workers who cannot be replaced" recently made public by the Manpower Commission. The die maker heads the list—number 1 keyman—and the tool maker has 4th place. Actually there is no difference in importance because those two trades are representative of the several craftsmen upon whom rests the responsibility for the tooling required for production.

Tools, dies, gages, jigs, fixtures, molds, and special cutting tools, along with standard tools, constitute the keystone of production. The most expensive machine tool cannot operate without its complement of small tools and the $100,000.00 stamping press is useless without its die. Tooling is fundamental; it is the most essential of essential products. Practically no production moves without it.

It follows logically that the men who design, develop and build tooling are "first line men" in the battle of production. They cannot be replaced because the time required for training is not a few months—it is years. And what is more, a tool or die maker becomes a really *good* craftsman only if he has an innate ability for developing mathematically correct "sculptures" in metal. True, today he does it largely by mechanical means, but it is a talent to be able to project the third dimension into a tool drawing or print and bring forth a perfect tool.

It is natural that the Selective Service should want to know about training in tool rooms, die and mold shops. It is safe to say that every tool and die shop, every tool room has in training today as many men, who have the required aptitudes and mathematical education, as its management can find. Not every applicant for such training can be used but when one has the "makings" he becomes valuable very soon. This is because die and jig and fixture building is often done by groups. The most experienced man is the leader and the others rank according to ability and experience. Thus the trainee is almost immediately a "gear in the train" although the least important. But remove him after one year and the only alternative is to start another and wait a year.

Because practically every die and special tool is individual, different from the one which preceded it, the trainee does not learn by repetition like in parts production. Therefore, tool and die makers, even those with years of experience, are always on the alert for improving their procedures. Descriptive and educational material is eagerly sought by them and many of them attend night classes which make "essential" even those qualified to instruct and write on tooling techniques.

By Eric N. Simons
Edgar Allen and Co., Sheffield, England. Mr. Simons is a well known authority on the British steel industry and joint author of "The Structure of Steel" and "Steel Manufacture".

Carbide Tools In War Work

THE proper tooling of machines employed in the manufacture of shell, precision parts for tanks, planes, guns and other munitions is of vital importance, not only because it is essential to conserve high speed steel, but also because of the increased output that must be obtained. Practice in Great Britain does not entirely coincide with American practice and the following is an account of the general principles in Britain.

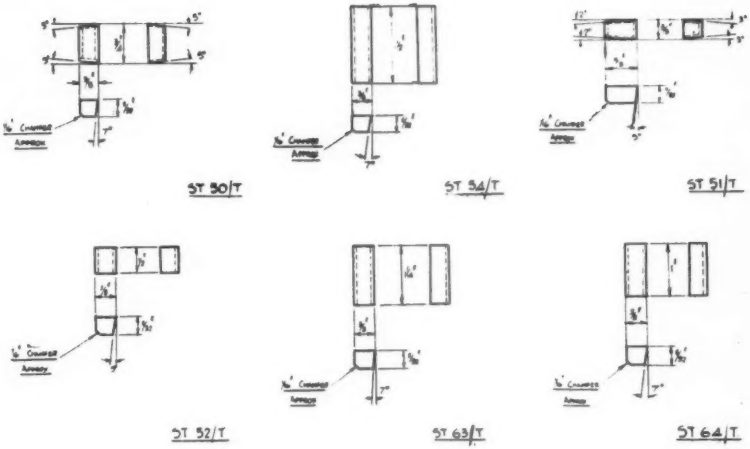
Before 1939, tungsten carbide was primarily used in Great Britain for the cutting of materials relatively low in tensile, such as cast iron, brass and so on, where the load on the tool was considerably less than that required for the successful cutting of steel. In this field, tungsten carbide had largely superseded high speed steel and the result had been considerable improvement in production.

With the advent of war it was soon appreciated that the maximum output possible had to be obtained in order to minimize the disadvantages due to the immediate lack of machine tools. This was particularly important in the making of shell, and at the present time in Great Britain by far the majority of shell are being rough and finish turned by tungsten carbide tipped tools. It cannot be denied that the mortality rate of the tools and tips has been high; higher perhaps than is pleasant to contemplate; and there is reason to believe that many British firms would have reverted to high speed steel for shell work if it had not been of paramount importance to effect high output at any cost.*

***According to leading cemented carbide manufacturers in the United States, the author is placing maximum importance upon tool cost, whereas the actual gage of results from the standpoint of economy should be based on the overall saving — the actual saving per piece machined.**

Use of Semi-Skilled Labor

It is now fairly well established in most shell shops that few tools employed on the rough turning of shell can expect to be re-ground a sufficient number of times to use up economically the whole of the tungsten carbide tip. The reason for this is that, as a rule, long before the tips become worn out by repeated grinding, an accident or an overload is encountered which breaks the tip and renders any further service impossible. Much of the labor now being turned on to shell work has been introduced solely as a result of the war and necessarily takes some time to accommodate itself to new conditions. There is only a cer-



Figs. 1-6 — Range of six cemented carbide tips for shell turning. Third angle projection method used.

tain amount of highly skilled labor in any country at the outbreak of a conflict, and the rapid expansion in production required necessitates bringing in trainees and semi-skilled workers, all of whom take time to become fully skilled.

To meet these conditions, the department of British Government responsible for production of ammunition issued, some time ago, recommendations in regard to special tungsten carbide tips. In general, the trend of design was in the direction of making the tips considerably smaller with a view to reducing considerably the ultimate wastage of tips. Figures 1 to 6 show these Government recommendations. Where previously a tip was shaped as in Fig. 7 it is now replaced by one on the lines of Fig. 6 and Fig. 5. From a study of these diagrams it will be obvious that a considerable economy in tungsten carbide has been effected.

In other instances, manufacturers have recommended reductions in the size of standard tungsten carbide tips. For example, instead of using a standard tool, as shown in Fig. 7, they have recommended tools with the same shank size, but tipped on the lines of Fig. 8 and Fig. 9. This, of course, is merely an alternative means of achieving the same economy.

In brief, it has been found in shell production in Great Britain, that the average number of regrinds that can be expected from tungsten carbide tools is about two or three, and that the smaller tip does the work as successfully as the larger tip.* It will be seen, therefore, that conservation of tungsten is effected, while the first cost of the tip is reduced. At the same time, grinding costs in making the tools are also minimized, which again involves a saving in abrasive grinding wheels.

***The Carboloy Co. has found by actual experience with United States firms that carbide tips for shell turning work can be reground approximately 10 times.**

Tools for Copper Band for Shell

Hitherto we have dealt to some extent with tungsten carbide in the form of standard tips for turning tools, but consideration must also be paid to form tools such as those employed in the production of copper band for shell. The trouble with tungsten carbide used for this work is that, being of special form,

the tools are highly expensive and more susceptible to extensive damage, particularly when so much unskilled labor has to be employed, as at the present time.*

*The labor on special form work here in the United States is approximately the same for high speed steel and tungsten carbide tools.

In Great Britain an extremely large number of composite steel tools have been employed on all types of machine operations. In these tools the end alone is of high speed steel, the remainder of the shank being an ordinary 0.4-0.5% carbon steel. These tools are fabricated by electric flash butt welding which has proved an eminently satisfactory method of uniting these two highly different types of steel. One well-known firm, now the largest maker of butt welded tools in Great Britain, first developed and placed them on the market some twelve years ago. At the outset, prejudice against their use was encountered. It must be admitted that certain technical difficulties had to be overcome and were only eliminated as a result of experience and thought. Today in Great Britain, the majority of works engineers and tooling specialists appreciate the extremely reliable nature of the butt welded tools, and are prepared to accept them without question. In fact it is probable that few machine shops in Great Britain today are not using butt welded super high speed steel tools for most machine operations.

The experience gained with butt welded tools is now standing British manufacturers of munitions in extremely good stead, owing to the fact that the outbreak of war in the Far East has cut off, at all events temporarily, the principal sources of tungsten, with the result that a considerable degree of tungsten conservation has to be practised in order to make the available supplies go round. There are factories in Great Britain turning out tens of thousands of butt welded tools each week, all going straight to the war effort and bringing about the utmost economy in tungsten, while at the same time enabling production engineers to obtain the highest speeds and feeds on such high tensile material as armor plate for tanks, etc., the results obtained being most gratifying. The economy achieved by these tools can be expressed in a simple manner. A bar of high speed steel will probably make about twelve solid high speed steel tools, but on an average that same bar will make a hundred or more butt welded tools. All of these tools are passed into the war factories and on to the machines and, having been already hardened by experts, will need no further heat treatment throughout their lives. When the whole of the high speed steel has been used up and ground off, the shanks become scrap, are collected together and re-melted in the Siemens furnace, and are then re-rolled into new supplies of shank steel.

Reclamation of Used Shanks

In this connection it is interesting to note that a scheme has been introduced for the national reclamation of used shanks of solid high speed steel tools. At one large works some thousands of worn tools were collected from the various machine shops and sorted according to the cross section of material, it being unnecessary to consider different grades of steel as the firm had standardized for some years on 18 percent tungsten material. As a rule such tools are sold by weight as scrap, the prices obtained being but a fraction of the original cost.

The discarded tools of solid high speed steel are cut into pieces of suitable size and welded on to steel shanks. Cemented carbide tipped tools have shanks of the same material so that these also are salvaged and used with high speed steel ends, or they may be re-tipped with cemented carbide.

Typical shanks and tips are shown at (a) in Fig. 10; the result after welding the tips and shanks together being shown at (b); while finished ground tools are shown at (c). In certain instances the shanks may be cranked or otherwise formed, typical examples being shown at (d).

Numbers of riveting tools are also used in these works. In the past, such tools have been discarded when worn but are now salvaged by cutting off the worn ends and butt welding new ends into position. A worn riveting tool, a tool with a new end welded into position and a finished machine tool ready for use, are shown at (e) in Fig. 10.

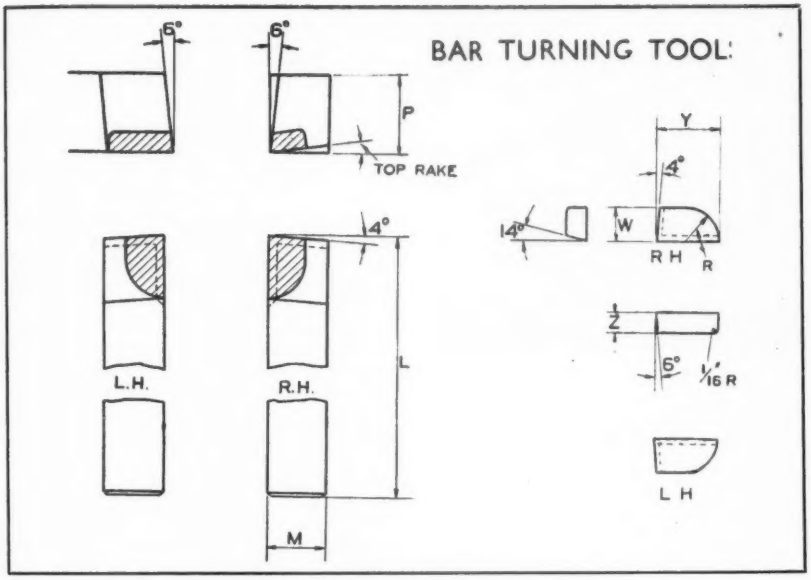
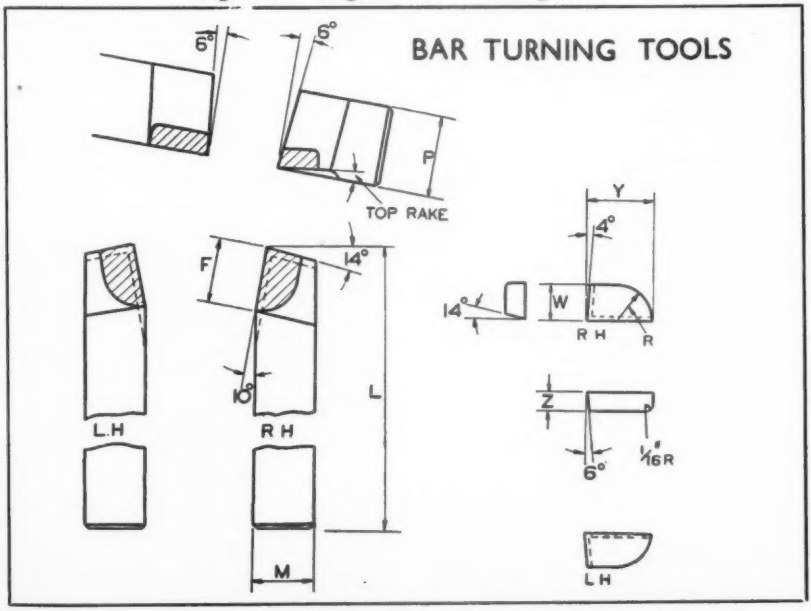


Fig. 7 — Diagrams of bar turning tools.

Figs. 8-9 — Diagrams of bar turning tools.



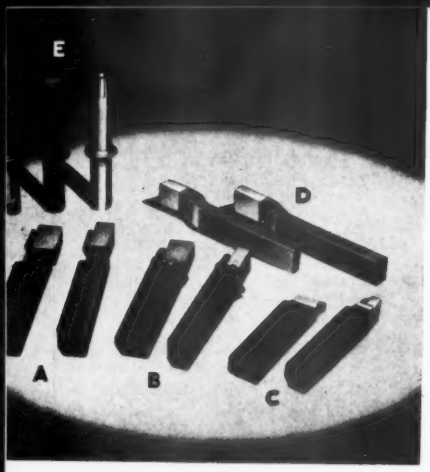


Fig. 10 — Steps in the process of obtaining new cutting tools by butt welding high speed steel ends reclaimed from discarded high speed steel tools onto carbon steel shanks.

Similar economies are effected in the use of high speed steel drills. Such drills of small size, which are usually soldered into their taper shanks, are removed and the shanks fitted with new drills of carbon or high speed steel as required.

Soldering Drills Into Taper Shanks

The equipment employed for soldering drills into their taper shanks is shown in Fig. 11. It comprises a gas-heated solder bath (a) around which are holes to receive the shanks. The gas-burner keeping the solder molten also serves to heat the shanks of broken drills, thus melting the solder and allowing broken drills to be removed. The heated shanks are treated with flux, as also are the parallel shanks of the carbon steel drills. The drills are then dipped into the bath of solder and inserted into the holes in the heated taper shanks, which have been partly filled with solder, the assemblies being then allowed to cool in the rack (b).

Economies have also been effected with high speed steel milling cutters. Cutters which have been rendered unfit for further service are annealed, re-cut and hardened to provide milling cutters of smaller diameters. Similarly when plug gauges become worn they are reduced in diameter by grinding and thus provide plug gauges of smaller size. Alternatively, such worn gauges may be reclaimed by chromium plating.

Centers have been set up nationally to convert used tools of solid high speed steel, and short ends of bar of rectangular section into butt welded tools. Metal of this type is bought for this purpose by the national centers, acting on behalf of the Machine Tool Control of the Ministry of Supply, and paid for at a price higher than the controlled prices of ordinary high speed steel scrap. The price paid is published from time to time in the technical press.

A firm has been appointed to distribute for and on behalf of the Machine Tool Control, Ministry of Supply, butt welded tools made available by this scheme. These tools are supplied at prices authorized by the Machine Tool Control.

It will be appreciated that tools made by experts in this way can be distributed to the genera' engineering shops who will thus obtain the maximum benefits from the use of high tungsten, high cobalt steels prepared in a most economical way; and since their preparation and particularly heat treatment is in the hands of the experts, the maximum benefits may be expected from the material employed.

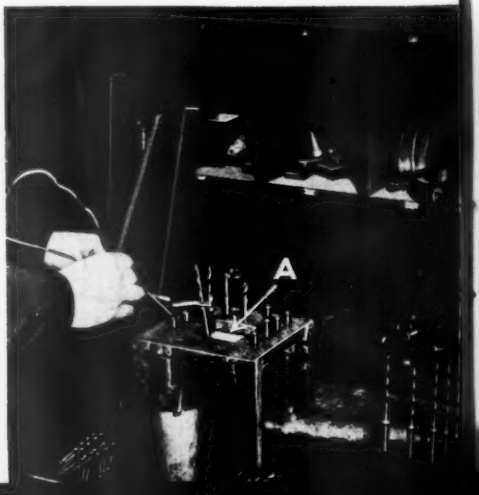


Fig. 11 — The equipment used for soldering the small diameter high speed steel drills into taper shanks of carbon steel.

Tool & Die Prices Must Conform to OPA Reg. 136

A study of the Office of Price Administration's Maximum Price Regulation No. 136 appeared in the July issue of The TOOL & DIE Journal. Many questions about its requirements were asked by members of the industries whose products and services are covered.

This review, prepared in cooperation with OPA officials, should provide tool and die shops and manufacturers with the information they need to make their charges conform with the Regulation.

If additional details or specific opinions are required, please write:

Earl C. Hald, Head—Parts and Subassemblies Unit, Machinery Branch, Office of Price Administration, Washington, D. C.

MAXIMUM Price Regulation No. 136 As Amended, and its subsequent amendments establish price control over the field of special tooling as well as over other important items of equipment and production. Tools, dies, jigs, fixtures and special gages; cutting tools; chucks, collets, mandrels and other machine tool attachments; and screw machine products are among the vital items contributing to the war program.

According to the provisions of the Regulation, these items, which are listed under Appendix B, are held to maximum prices no higher than those of March 31, 1942.

The terms, tools, dies, jigs, fixtures, and gages, are too well understood by members of the industry to require definition. However, in order to avoid misunderstandings in regard to the coverage of the Regulation, we offer brief general definitions of the several items in question.

Definition of Coverage

The general designation, tools and dies, includes all the specially designed and constructed mechanical devices and production accessories frequently designated "special tooling" for blanking, bending, clipping, drawing, embossing, extruding, forging, forming, piercing, spinning, swaging, trimming or otherwise "working" metals and other materials, whether hot or cold. Dies used in hot forging and die casting, and molds for plastics molding are also included. Thread cutting dies, including taps and chasers, are excluded from coverage by this Regulation, and are subject to the General Maximum Price Regulation. Machinists' tools, carpenters' tools, and hand tools, except those specially designed for work on military equipment, are also excluded, and fall under the General Maximum Price Regulation. Diamond dies of less than .002" diameter are not subject to price control at present.

Jigs and fixtures refer to the specially designed devices for guiding or locating

tools, and for holding work during mechanical operations in manufacturing interchangeable parts. The common distinction is that a jig is used to guide or locate tools, and is free to center itself—for example, in drilling operations—while a fixture is used to hold work securely in position, and is fastened to the table or bed of the machine. Milling operations illustrate the latter application.

Gages, such as are referred to in this instance, are the special purpose type made to customers' drawings, usually to accompany special sets of tools. Typical ones are plug, ring, snap, height, length, template or profile, and location gages. (General purpose graduated or adjustable gages such as micrometers and vernier calipers, on the other hand, are included in Appendix A of the Regulation under the general classification of mechanical measuring instruments, and therefore have an October 1, 1941 base date.)

"Loading the Injection Mold" by Don F. Hoffman appears on page 90 in the Plasticator Section of this issue.

Perishable or expendable tools are also placed on the B Appendix of the Regulation, and are subject to price levels of March 31, 1942. We refer in this case to tools that wear or are consumed in the processes of production and require periodic regrinding and sharpening. Steel and cemented carbide cutting tools, such as are used in lathes, shapers, milling machines, and the general types of standard small tools found in the normal tool room or machine shop, are illustrative of this type.

Pricing Provisions

In the case of products which have a list price (for example, perishable tools) the manufacturer is required to file such list prices in effect March 31, 1942 with the Office of Price Administration, Washington, D. C. Such prices must be maintained (as a maximum); wage increases or other increases in costs must be absorbed by the manufacturer. In case of hardship due to absorbing increased manufacturing costs, the manufacturer may seek relief by filing a petition with the Office of Price Administration in accordance with established procedures.

Products without list prices, which include most special tools, dies, jigs, fixtures, and special gages, are to have their selling prices computed according to the pricing formula embodied in Section 1390.7. This formula provides for these items that maximum prices shall be determined in accordance with the method in use on March 31, 1942, and the wage rates, material prices, and overhead rates in effect on that date. Builders of non-list price items are not required to file prices, but must keep complete and accurate records of costs and sales. If the price as computed by this formula is at any time increased above the price charged on the previous sale or above the original contract price, the seller must make a report within ten days to the Office of Price Administration, Washington, D. C., in accordance with the provisions of Section 1390.18 (g). No price increases on repeat orders due to labor increases are permitted, but the Office of Price Administration will permit the use of such quantity differentials and contingent set up charges as existed in the price-determining method on the base date.

If the amount of overtime has been increased beyond the amount allowed for in the price-determining method on March 31, 1942, the builder is permitted to recover the additional bonus payments. He may not, however, use any of the resultant increased direct labor costs as a basis for an increase in the mark-up, overhead, or profit. Moreover, where the overtime results from an unforeseen contingency, he must bill the charge separately.

(Continued on Page 140)

By H. S. Kartsher
The Brush
Development Co.

Surface Finish Inspection

THE entire subject of surface finish inspection and specification has, unfortunately, been beclouded with an air of mystery. This has been due, first, to a lack of definite conviction on the part of the user of finely finished parts as to just what is required; and second, to a lack of instruments and apparatus to accurately tell the full story. It is the writer's personal opinion that most efforts in the direction of standardization of surface finish specification have failed or bogged down because the attempt has been made to cover *too much ground with one standard.* For example, a standard intended to cover the rough surface of castings would be entirely inapt for use in connection with the "pimpled" surface of sheet metal preparatory to enameling, and neither of these would be applicable to a bearing surface intended to carry a load with a minimum of friction.

The work of Committee B-46, sponsored by the Society of Automotive Engineers, and the American Society of Mechanical Engineers, on a proposed American standard for surface roughness is outstanding in this particular. This work was intended to cover only one phase of the subject of surface finish; namely, roughness. Unfortunately, this has been more or less generally interpreted by the average user as the only specification required.

The most unfortunate part of the whole situation is the fact that no organized attempt has been made on the part of Committee B-46, or its sponsors, to disabuse the mind of the average user in this connection. The result has been that most firms who have attempted to use the standard are attempting to specify the entire condition and preparation of the surface by a single number—the RMS average roughness.

For the sake of being explicit, our remarks here are concentrated on "bearing surfaces", as it is felt that this would constitute a wide scope of surface finish quite sufficient for a single standard, and would include most surfaces of immediate interest in the production problems of the present war effort. These bearing surfaces could include rotary or reciprocating surfaces, either flat or cylindrical, for carrying loads or guide bearing purposes. They might also include surfaces subject to no motion and very little load, such as gas or hydraulic seals. Such a standard might also be extended, by a stretch of the imagination, to cover such "air fit" surfaces as the polished surfaces of piston rods and the like, where the high finish is intended to resist corrosion and provide against fatigue checks.

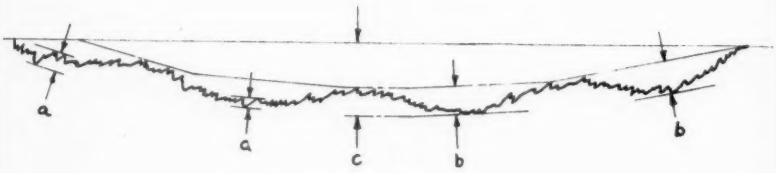


Fig. 1 — a – Roughness
b – Wave
c – Truth

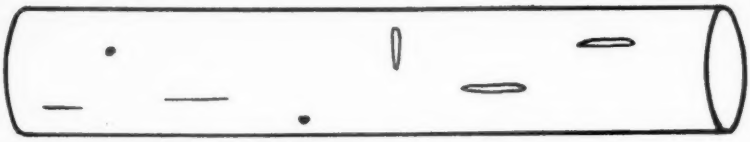
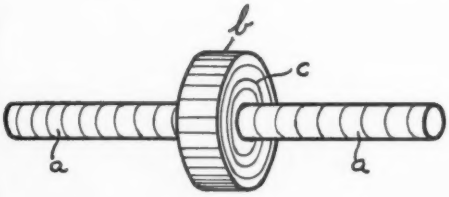
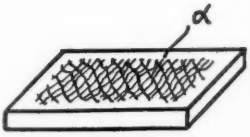


Fig. 2 — Flaws, caused by handling

Fig. 3 — Pattern, an indication of the type of operation
a — Circumferential
b — Longitudinal
c — Rotary
d — Multi-plex





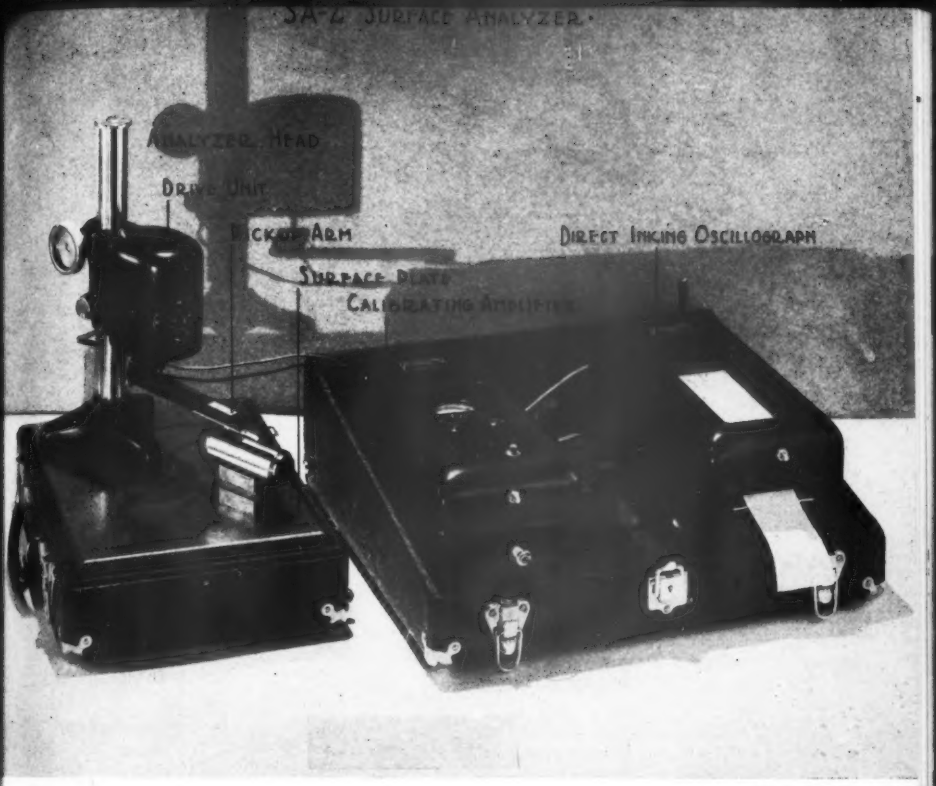


Fig. 4 — Brush Surface Analyzer

There are several elements of any given surface which must be considered if that surface is to perform in the manner intended:

1. *ROUGHNESS*, as shown at (a) in Fig. 1, is created by the removal of metal from the surface by any given production method, such as turning, grinding, lapping.

2. *WAVE*, as shown at (b) might be caused by chatter, non-rigidity of the machining elements, grinding wheel diamond marks.

3. *TRUTH*, as indicated at (c), could be interpreted as "flatness" in flat work or "roundness" in round work, and approaches what might be called a dimensional or geometric quality of the surface. Of course, all of these characteristics are dimensional in the true sense of the word. However, the first two elements mentioned—roughness and wave—are of such minute character that they are outside the realm of the ordinary measuring instruments as we know them now in the shop. It therefore becomes a matter of deciding upon definitions to determine where roughness stops and wave begins, or where wave stops and truth begins.

4. *FLAWS*, as illustrated in Fig. 2, might be caused by handling, scratches from stray grains, failure to clean up and blow holes.

5. *PATTERN* (sometimes referred to as "lay"), as illustrated in Fig. 3, is an indication of the type of operation: (a) might be considered a circumferential pattern, as produced by the ordinary grinding or lapping operation; (b) might be considered a longitudinal pattern, as produced by a draw-hone operation, or an operation of "lapping in place". (c) might be considered a rotary pattern produced by a lapping or polishing operation; (d) might be considered

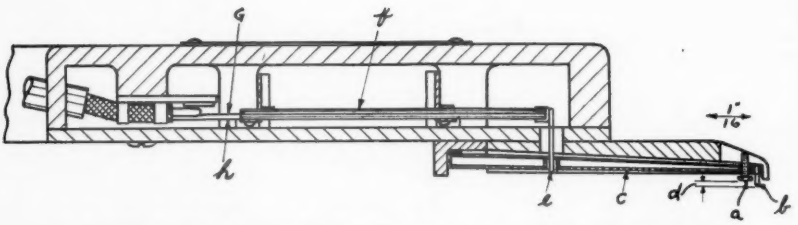


Fig. 5 — Pickup arm. a — Positioning shoe. b — Diamond tracer point. c — Spring arm. d — Dimension. e — Rod. f — Piezo-electric crystal. g — Leads. h — Leads

a multi-plex pattern, such as would be found on the surface of a gage block or produced by any multi-motion or "super-finishing" operation.

6. *APPEARANCE*, would take in such matters as: the degree of polish; reflectivity; sand blasting, etc. The difficulty of taking in all of these elements with one number is readily apparent, and there is at the present time no one instrument on the market capable of measuring all of the elements mentioned above.

The same type of problem was presented to industry at the time the national standards were developed for screw threads. Pitch diameter, outside diameter, root diameter, angle, form, drunkenness, etc., must all be measured by different types of instruments. However, a standard was developed to provide certain classes of fit and specifying maximum limits for each element under each class. This standard has served for the past twenty years with quite a fair degree of satisfaction. It is our opinion that some such classification of bearing surfaces can be developed with very satisfactory results.

The Brush Surface Analyzer (Fig. 4) was developed primarily for the inspection of roughness, but will also give some indication (within very small limits) as to wave. In principle, the Brush Surface Analyzer comprises a diamond tracer point, which is drawn over the surface under inspection by a drive head producing a uniform motion. The drive head is operated by a synchronous motor and cam movement, the cam having a rise of $\frac{1}{16}$" and completing one cycle in ten seconds. A cycle is a straight line stroke, $\frac{1}{16}$" up and $\frac{1}{16}$" back, thus producing a traverse of .125" in ten seconds. Fig. 5 diagrammatically illustrates the pickup arm in which (a) is the positioning shoe provided with a large radius which will span many of the ordinary irregularities found on an abraded or turned surface. Thus, the positioning shoe becomes the reference level from which the measurements of irregularities in the surface are taken. (b) is the diamond tracer point, formed to a 90° cone, and terminating in a .0005" radius.

As the tracer point is drawn over the surface, the crystal (b) acting as a spring maintains contact between the tracer point and the surface under inspection. Under ordinary adjustment, dimension (d) is set at approximately three-quarters of a thousandth, which causes a pressure of approximately one-third gram. This tracer pressure will not cause scratching of most of the finished surfaces generally found in production and for very soft materials, such as certain bearing metals, the pressure can be reduced to approximately 0.02 gm by adjusting the level of the pickup arm.

Vertical motion of the tracer point (b) is transmitted through the spring arm (c) and through the rod (e) to the piezo-electric (Rochelle salt) crystal (f). It is the nature of this crystal to generate a small electric voltage in direct proportion to the amount of deflection and of a polarity (positive or negative) in accordance with the direction of the deflection. This voltage is carried through leads (g) and (h) to the calibrating

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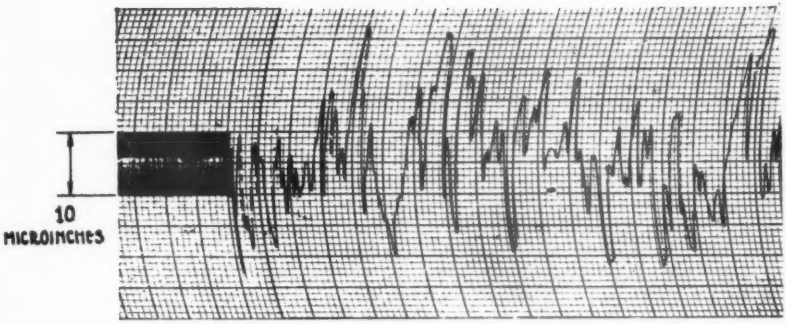


Fig. 6 — Result of recording a ground surface

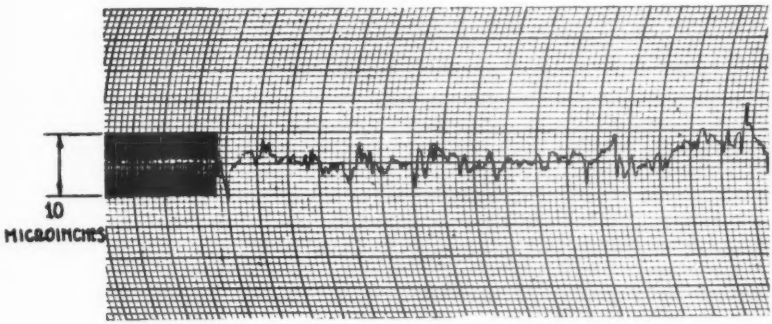
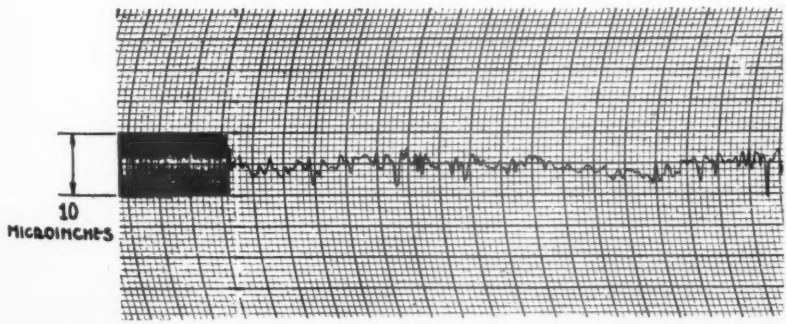


Fig. 7 — Result of recording a honed surface

Fig. 8 — Result of recording a super-finished surface



By Thomas J. Lester
Designing Engineer
Lester Engineering Co.

An Aluminum Die Casting Die

Design and Construction

IN the first world war, die casting played only a small part as compared with the importance it commands today. The only material that was practical to die cast 25 years ago was zinc, although a few aluminum castings were an indication of success to come. Today it is possible to die cast zinc, aluminum, brass, and magnesium on a production basis. The development of high pressures, excellent modern equipment, and the fine alloys now used brought this to pass. Also, today's die steels and improved die designing practices have influenced this major improvement. Die casting should flourish in post war days because the competition created in the stabilizing of industries will force consideration of any economical production practice, such as die casting, for manufacturing the many items of commerce.

Design Features

Today it is very important, in fact absolutely necessary, to save critical materials of every kind and particularly to use as little high grade steel as possible. At the same time, tools and dies must be designed and built to deliver maximum service. Simplicity should govern designs.

The die illustrated in this article consists of five critical parts that must be made out of good tool steel and hardened. These are the plunger metal bushing (Detail 17), the gate block (Detail 20), the gate cover block (Detail 18), the cavity insert (Detail 2), and the core insert (Detail 7).

In operation, when the die casting machine plunger forces the aluminum into the die at the pressure of ten tons psi and at a temperature exceeding 1,000° F, the steel contracting the aluminum has to withstand both the extreme heat and pressure. That is why the two gate blocks (20) are incorporated in this die. It would be possible to eliminate these blocks by using higher grade steel and hardening the cavity and core insert plates. This process would, however, be just as expensive because: 1. These large plates would have to be hardened. 2. If the gates check or wash, as they might on long runs, new plates would have to be made. 3. Material cost would be higher. 4. If a change in gating is necessary to produce a good casting, it will be much

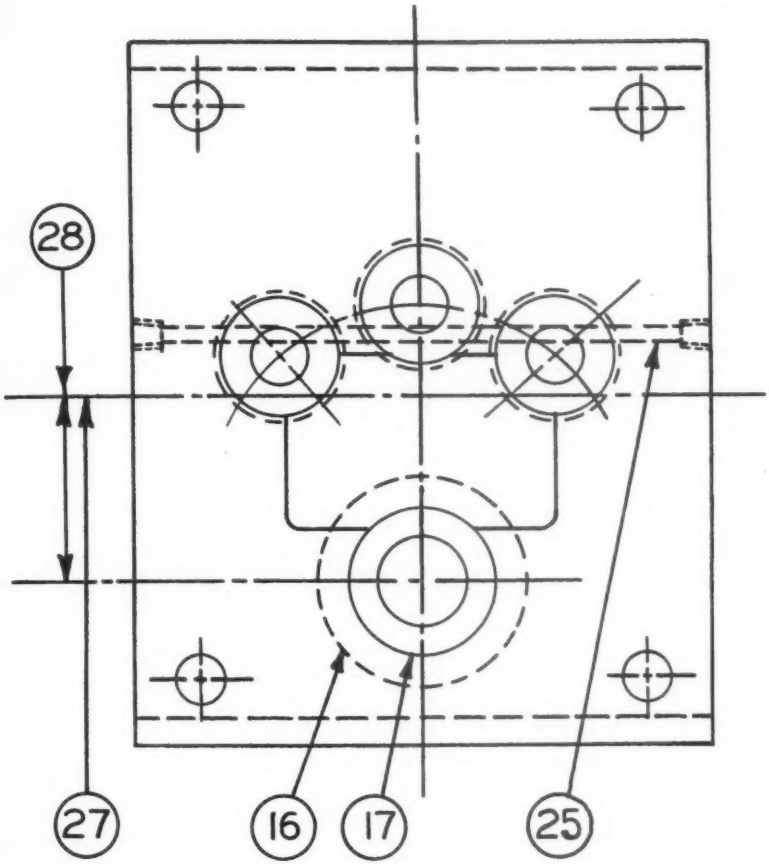


Fig. 1
View of Die Facing Cover or Injection Half

PRINCIPAL PARTS

1. Cover Binder Plate
2. Cavity Insert
3. Cavity Insert Plate
4. Guide Pin
5. Guide Pin Bushing
6. Core Insert Plate
7. Core Insert
8. Ejector Binder Plate
9. Ejector Box Leg
10. Ejector Pin
11. Support Post
12. Ejector Pin Retainer Plate
13. Ejector Plate
14. Clamping Groove
15. Clamping Groove
16. Metal Cylinder Register
17. Plunger Metal Bushing
18. Gate Cover Block
19. Slug Radius
20. Gate Block
21. Ejector Box Leg
22. Machine Ejector Rod
23. Surface Pins
24. Water Hole
25. Water Hole
26. Gate
27. Die Centerline
28. Metal Cylinder & Die Centerlines
29. Machine Die Space
30. Machine Movable Die Plate
31. Machine Stationary Die Plate
32. Metal Cylinder

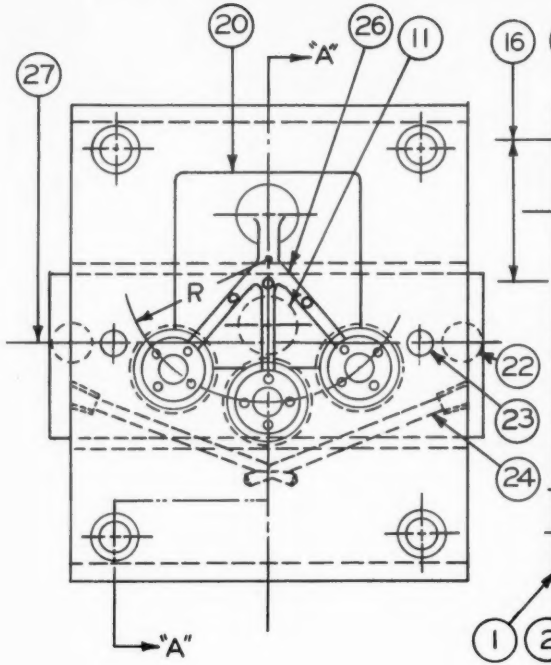


Fig. 2
View of Die Facing Movable or Ejector Half

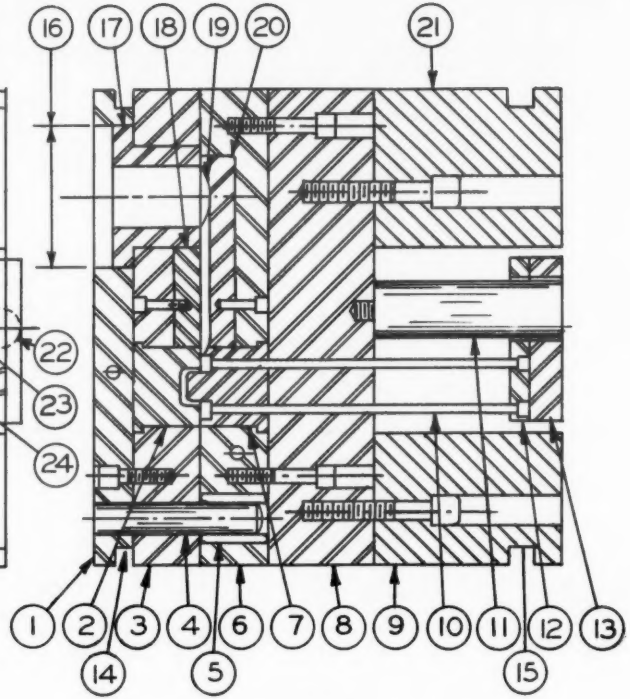


Fig. 3
Sectional Elevation of Die

easier to change the gate block (20) and gate cover block (18) than it would be to change a hardened cavity insert plate (3) or a core insert plate (6).

When the die casting machine plunger travels forward through the metal cylinder (Detail 32, Fig. 7) into the plunger metal bushing (17), the material hits a spherical (19) instead of a flat surface. This tends to guide the metal into the gating with less restriction. If the die is not correctly supported when the cavities and the gates are displaced with metal, the force of the plunger shock might cause spitting or other serious difficulty. In this case there is no open-

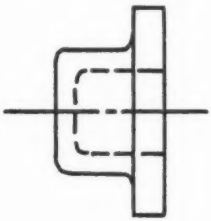


Fig. 4
Aluminum Die Cast Part

ing in the ejector die half, directly opposite the metal plunger. In the ejector box opening a large post (11) is so placed as to prevent the ejector die from bending at this section.

In die casting aluminum, the molten metal is ladled into the casting machine metal cylinder (Detail 32, Fig. 7) and it immediately seeks its own level by gravitation. This makes it necessary to place all gates and cavities above the metal cylinder to prevent the material from entering them.

The die casting machine for which this die was designed is constructed in such a way that the metal cylinder (32) may be lowered from the center line of the machine (Detail 27, Fig. 7) as shown in Detail 28, Fig. 7. This feature makes it possible to design the die to fit into the center of the machine die plates where the locking pressure or pre-load is most effective. When designing a die casting die, it is always best to concentrate the projected area of the metal cavities as closely to the center of the die as possible, and to provide at least a two-inch shutoff beyond the cavities to the outside of the die.

In the die here illustrated, the centerline (Detail 27, Figs. 1 and 2) will correspond to the centerline (Detail 27, Fig.

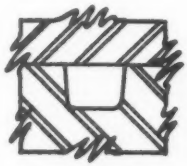


Fig. 5
Cross Section of one type Gating

7), and the machine metal cylinder (32) will be lowered the same distance as is shown (Detail 28, Fig. 1). This will correspond to Detail 28, Fig. 7.

Many die casters believe in a wide, thin gate as is shown in Fig. 6. It has been found, however, that by using a narrow, deep gate, there are two advantages to be gained: 1. When running thin casting or thin sections, the cavities fill easier because less chilling takes place in the gating. 2. The projected area at the parting line of the die is decreased; therefore, there is less strain on the die and the machine. In many cases, this feature has made possible

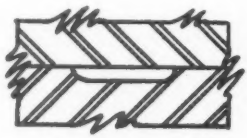


Fig. 6
Cross Section of another type Gating

production of better castings, or has eliminated die spitting, particularly on lighter or older types of die casting machines.

An important principle that a designer should respect in designing multiple cavity dies is to place all cavities as nearly equidistant from the point of injection as possible, as shown in Detail R, Fig. 2. This insures as nearly as

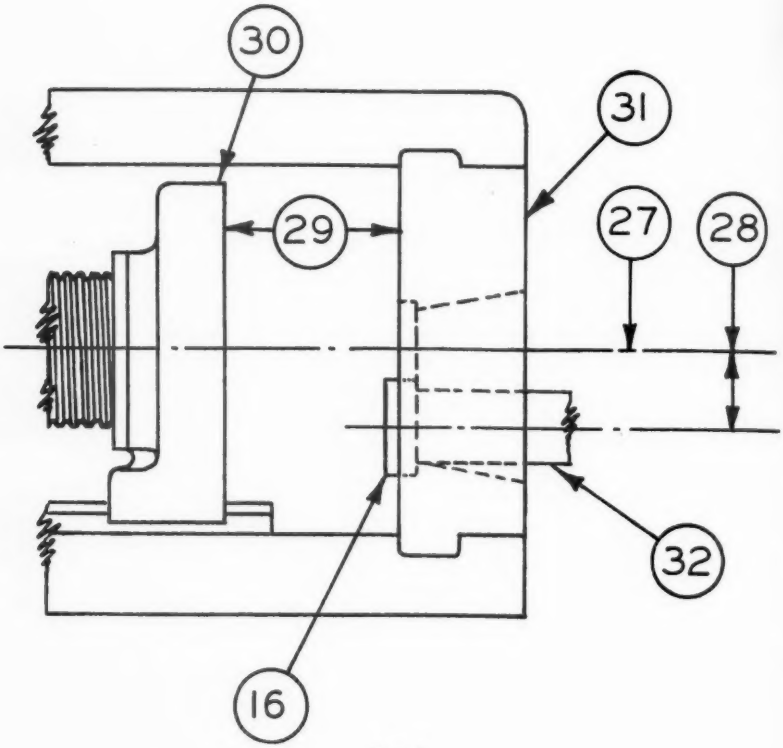


Fig. 7

View of Die Facing Injection Section of Die Casting Machine

possible the uniform filling of all cavities, otherwise one cavity will fill and chill before others are displaced. The first ones to fill might be rejected because they would chill before the final squeeze could be applied, thereby causing a porous and otherwise poor quality casting.

In this die design, the common type ejector pin is used for ejecting the casting. When the die opens, two machine ejector rods (22) stop the ejector plate after a certain amount of the machine opening distance has been traversed. For example, if the machine movable die plate (Detail 30, Fig. 7) moves back ten inches, and the ejector plate stops at nine inches, the ejector pins (10) will have pushed the shot—which consists of the gates and the castings—out of the die cavities one inch.

The function of the surface pins (23) is to push the ejector plate, retainer plate and ejector pins back to the casting position indicated in Fig. 3. After the ejector plate has lifted the surface pins in ejection along with the ejector pins, the cavity insert plate (3) in closing will push the surface pins back to the parting line the distance which they had been ejected.

When the plunger moves forward, filling the die (gates and cavities), there is always a slug or excess amount of material left in the plunger metal bushing. The die designer should not be concerned about how to get this slug out, because as the die opens, the machine

(Continued on Page 128)

A Series—X

by C. W. Hinman
Designing Engineer

Modern Milling Fixture Design

CUTTERS having formed teeth are used when side milling large quantities of work in which the sectional shapes are different than plain angles. This is because their teeth can be ground across their faces when sharpening, which maintains the contour and size of the cut throughout the life of the cutter. No other type of milling cutter has this desirable feature. All others must be ground on their tooth edges, thus losing their contour and size after the first grinding.

Figure 53 shows a formed profile milling cutter set up for action. This cutter has a tapered shank that insures concentricity of the shank and cutter head, after the shank has been firmly inserted into the spindle collet of a milling machine. These cutters are generally used, but not necessarily so, in a vertical position, as shown in Fig. 53. But they may also be used in a horizontal spindle machine, or in a swinging-head attachment, inclined at any angle between zero and 90°. The fixture for holding the work is then designed to suit the angle.

Straddle Milling With Formed Cutters

In Fig. 54 is seen a commonly used setup in which right and left hand "quarter-round" formed milling cutters are used for shaping the edges of work. These types of milling cutters are commercial and can usually be purchased in various lengths of tooth radii for making different sizes of quarter-round cuts. Ordinarily, commercial cutters in all sizes and shapes may be purchased either of carbon steel or of high speed steels.

The question naturally arises, can formed milling cutters be successfully used in gangs together with edge ground cutters? In certain types of gang milling cutters this can be done, but in most types of gang cutters it would not be practical. It can be done in gangs where the edge ground cutters do not make face cuts, in other words, when these types of cutters are ground only on the side edges of their teeth. The diameters of formed cutters change very little after grinding the faces of their teeth. On the other hand, the diameters of edge ground cutters are changed materially after grinding their face edges. It is, therefore, obvious that after grinding the two types of cutters in the same gang, the difference in diameters would seriously change the relative depths of their cuts. In extensive milling operations gangs of cutters usually remain

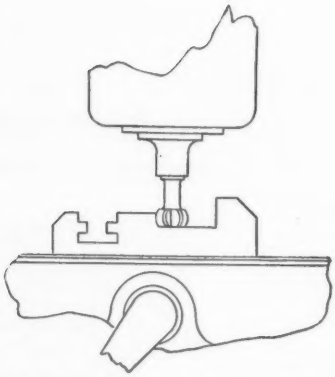


Fig. 53 — Shank type of formed profile milling cutter, machining the section of an arc along one side of a channel in a block.

set up on their arbors and are never "torn down" except for grinding.

Figure 55-A shows a formed cutter setup for straddle milling the teeth in standard sprocket wheels. Sprocket teeth produced with these types of cutters are not so accurate as those produced with the standard single space cutter shown in Fig. 55-B. The only advantage in using the cutter design shown in Fig. 55-A is that fewer cutters are required to cut a complete range of teeth—as 7 teeth and up.

Triplex Formed Cutters for Gear Teeth

Two operations are necessary when cutting large gear teeth and using triplex cutters. These operations are the roughing and finishing cuts, as shown in Fig. 56. In the Gould and Eberhart system of milling gear teeth, duplex cutters are used in gangs of two or more; the number of cutters in the gang depending on the number of teeth in the gear to be cut.

Cutting Gears in Mass Production

In the mass production of small spur gears, such as are used in automobiles and airplane motors, the teeth are usually cut on a gear shaping machine. The center hole in the gear blank is placed over a vertical stud in the holding fixture and is then clamped in a horizontal position. The shape of the cutter corresponds with the tooth spaces to be cut and the machine reciprocates the cutter up and down in front of the edge of the blank as seen in the down stroke, Fig. 57. The fixture feeds the blank slowly into the cutter and indexes one tooth space after each cut has been made. This operation is repeated until the root depth of each tooth space has been finished. The cutter is of the disc type and carries a number of equally spaced cutting teeth. These cutters are also made for roughing and finishing and may be indexed ahead one tooth after each cutting cycle.

Thread Milling

Worm thread milling cutters are made in a variety of different types. Some must be profile ground (edge ground), while others have formed teeth and are face ground. In Fig. 58 is seen a formed tooth multiple threading cutter which has a tapered driving arbor. These cutters are made either right or left hand and can be used for cutting internal or external threads. As illustrated, the work is "chucked" in a collet which revolves in the opposite direction to that of the cutter. The work holding collet is a part of the thread milling fixture.

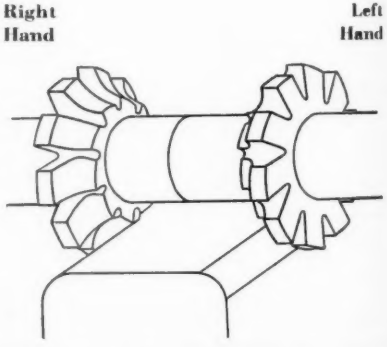


Fig. 54 — Right and left hand formed milling cutters, machining arcs on two opposite corners of a block.

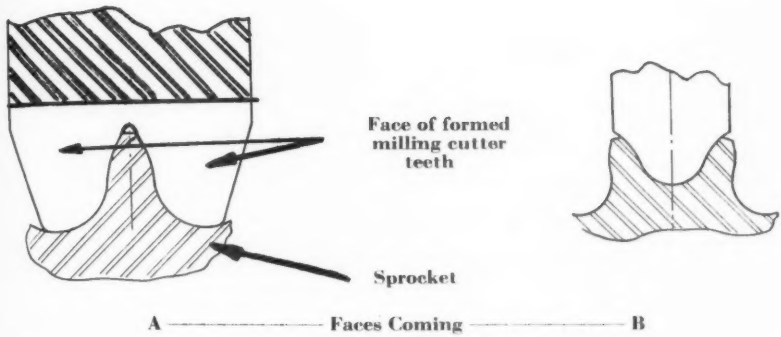


Fig. 55 — A formed milling cutter set up for straddle milling sprocket wheel teeth

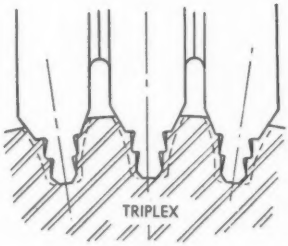
While the cutter is revolving and cutting, it is withdrawn from the work coincident with the "lead" of the thread being cut. The revolutions of the work collet are "timed" to cause the work to withdraw either from the cutter or vice versa as shown in Fig. 58.

Gang Milling With Formed Cutters

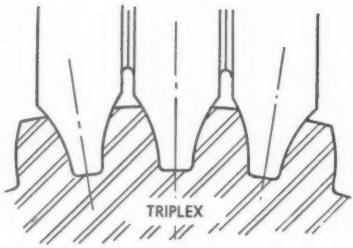
Figure 59 is a reproduced photograph of a milling machine showing a gang of three formed milling cutters in action. The body of the holding fixture is of cast semi-steel and eight pieces of work are clamped at one time (flat sides together) by a plate with tightening nuts (not shown) in front of the fixture.

This is a picture of a finishing cut. The work has been previously rough slotted and ends cut off at angles. The cut is just beginning. The cutters are revolving anti-clockwise and, therefore, the table and work is moving away from the eye of the camera. The cutter arbor is supported by an outboard bearing shown at the ends of the two parallel overarms. This provides rigidity for the cut and prevents chatter of the teeth while cutting.

A lubricating coolant is delivered directly on the cutting operation. The spaces between the cutter teeth are generously large for clearing chips. The side cutters are right and left hand. Their teeth are cut at such an angle to the arbor that favors the forcing of chips out on either side of the cutters. The largest cutter, which is the one for



1st operation
Roughing



2nd operation
Finishing

Fig. 56 — Large gear teeth are sometimes milled with triplex roughing and finishing cutters, depending upon the number of teeth in the gears.

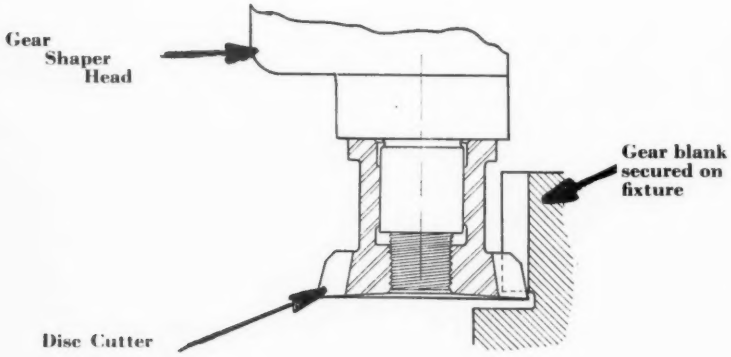


Fig. 57 — Cutting teeth in a gear shaping machine. The gear blank and cutter disc are each "indexed" one space ahead after completing each cutting cycle.

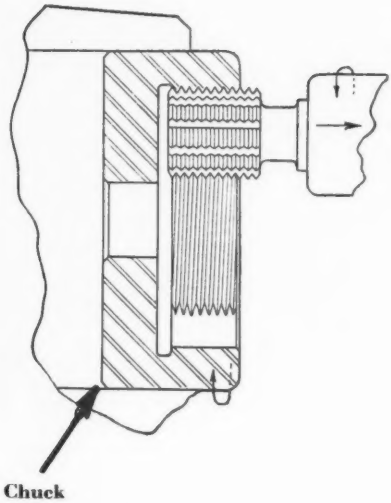


Fig. 58 — Multiple thread milling of either internal or external threads.

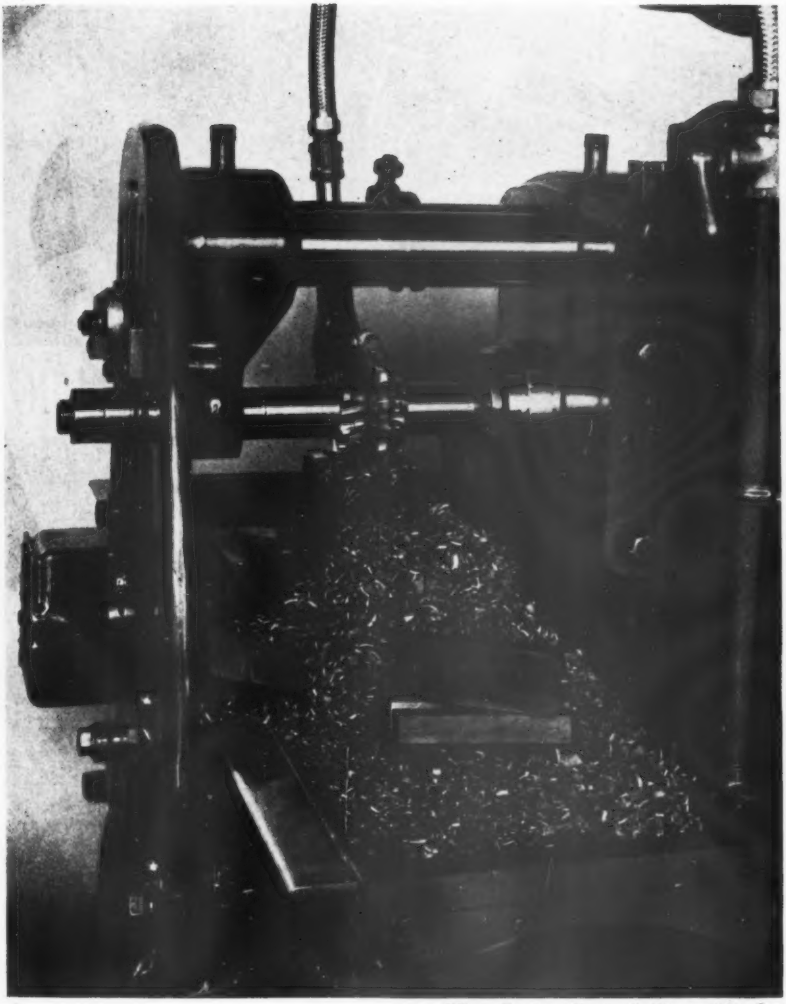
slotting, has the alternate faces of its teeth ground in opposite angular directions. This feature provides an easy shearing, balanced cut which is necessary in cutting a deep slot such as this one. Two finished pieces of the work are seen in the foreground on the table of the machine.

(Drawings Courtesy Illinois Tool Works)

REPRINTS

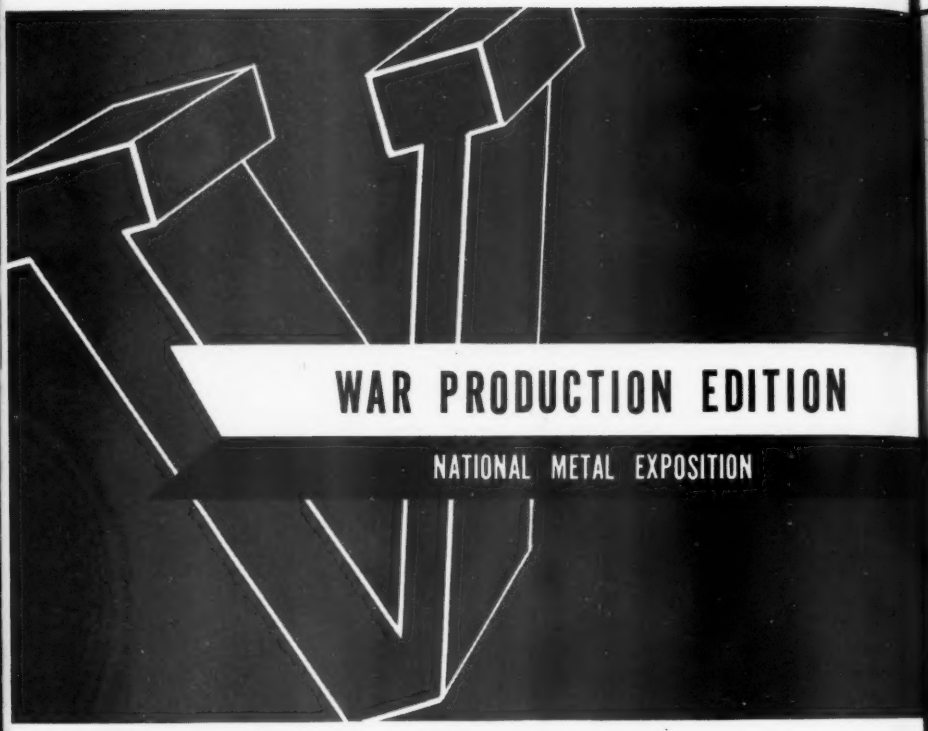
"Typical Designs for Drilling Jigs and Fixtures," a series in six parts, has been reprinted by popular demand. This series has been written by C. W. Hinman, well-known engineer and author of "Pressworking of Metals" and "Practical Designs for Drilling & Milling Tools."

Copies may be secured by writing The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O. Price, 25c per copy.



(Photo Courtesy Brown & Sharpe Mfg. Co.)

Fig. 59 — A gang comprising three formed milling cutters which are slotting and shaping the ends of eight steel "dogs" in one pass of the milling machine table.



THIS is a War of Metals. It is to be also a War of Men according to Major General Lewis B. Hershey's recent statement that 13,500,000 men will be needed for the Armed Forces of the United States.

Thus will emerge the combination of *men* and *metals* with which we shall crush the aggressor nations. If the brunt of the offensive action can be borne by America's metal working industries through the medium of their products, a tremendous saving in human life can result. To this end the American Society for Metals, the Wire Association, the American Welding Society, and The Iron and Steel and Metals Division of the Metallurgical Engineers are gathering in Cleveland to pool their technical knowledge and skills for the sole purpose of increasing and improving production of war materiel.

The members of these four societies by freely exchanging their hard-won data, the exhibitors by their showings of new and improved processes, materials and equipment, and war plants by accepting and placing in operation every advancement offered, will make notable contributions to saving of American soldiers' lives through betterment of military equipment.

Every technical session, every discussion, every exhibit of the 1942 National Metal Congress and War Production Edition of the National Metal Exposition was planned as a contribution toward speeding production of tanks, planes, ships and guns and improving them to the end that they will be superior to those of all other nations.

Carboloy Company, Inc. Detroit, Mich.

METHODS of simplifying all-out mass production for war was the keynote of the Carboloy exhibit at the National Metal Exposition.

Featured was the greatly expanded line of standardized mass produced carbide tipped cutting tools and blanks—most of which are available from "stock" today, in spite of the tremendous increase in demand for such tools.

Included among the tools and blanks were added types of standard turning, boring and facing tools and standard blanks; new round shank boring tools, both tipped and solid; etc.

Also to be exhibited are newly standardized Carboloy dies already in wide usage for producing cartridge cases.

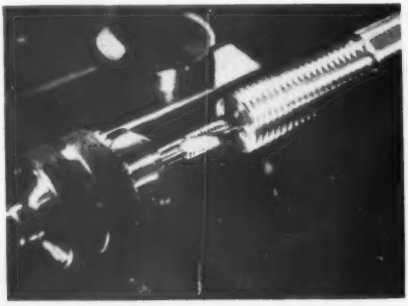
Aluminum Company of America Pittsburgh, Pa.

THREE new How-To-Do-It motion pictures, produced by Alcoa, are available for loan at no charge for group instruction. These are task instruction sound movies full of know-how for the welder, machinist and riveter working with aluminum.

"How to Weld Aluminum" shows the essentials in torch welding, arc welding, brazing and resistance welding aluminum. Demonstration welds are made in close-up for each of the welding processes to illustrate the proper technique.

"How to Rivet Aluminum" graphically portrays the making and testing of rivets, the preparation of the work, the actual riveting and final inspection.

"How to Machine Aluminum" presents an outline of the best practices to employ when machining aluminum with either hand or machine tool. Discussed pictorially are the alloys commonly employed—those which are soft and gummy as well as those of the free-cutting type, the proper top and side rake and the proper clearance for the tools.



Hammond Machinery Builders Kalamazoo, Mich.

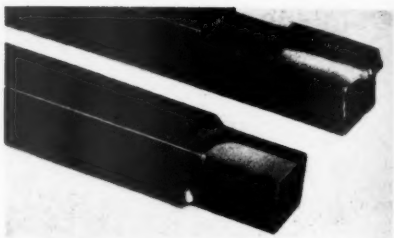
THE Hammond Model 4 Chip Breaker Grinder performs its functions with maximum speed and being ruggedly built does so with vibrationless, smooth, operation.

The right side is for chip breaker

grinding. It is designed and built for precision tool setting and accurate groove grinding with a 4" diameter diamond wheel. Beneath the diamond wheel the Any-Angle Vise is mounted on a cross slide fed by a hand wheel calibrated to .001"

The left side of the Model 4 can be equipped for cup wheel grinding, making it a combination machine for complete carbide tool maintenance.

Eutectic Welding Alloys, Inc.
New York, N. Y.



THE Castolin Eutectic Low Temperature Welding Process is used for joining cast iron, steel of all analyses, copper, brass, nickel, monel, aluminum and alloys, magnesium and die castings. The alloys and base metals develop a strong affinity for each other, even though the melting point of the applied metal is far below that of the parent metal.

War production plants have utilized this process extensively for the reclamation of defective and broken tools. For butt welding, where great strength is needed and for salvaging of reamers, taps, drills, etc., Castolin Alloy No. 16 has given excellent results.

The illustration compares the usual, recessed tungsten tipped tool with the new, time-saving, butt-welded tip. Both were welded with high tensile Castolin Alloy No. 16.

Magnetic Analysis Corp.
Long Island City, N. Y.

MAGNETIC Analysis Dual Method Equipment permits economical inspection of an entire lot of material at production speed.

With one passage of the material through the Dual Method Equipment, simultaneous indications are given as to whether the material is free of mechanical defects and as to whether it is of the same chemical analysis, heat and

structure as the sample originally used for calibrating the equipment.

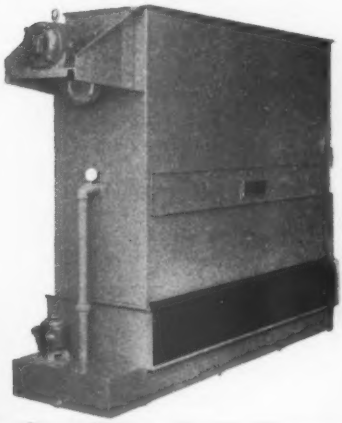
This equipment is made in separate units and is semi-portable. It consists of an indicator unit, an indicator power supply unit, a coil unit and an accessory unit.

Behr-Manning Corp., Troy, N. Y.

COATED abrasives, better known as sanding "gadgets", have solved a multitude of finishing and polishing problems, particularly in connection with the making of tools and dies. These abrasive cutting, finishing and polishing tools together with the Coated Abrasive Specialties illustrated do a better job faster than any hand method.

The Niagara Blower Co.
New York, N. Y.

A NEW evaporative type unit for removing heat from various industrial liquids, quenching baths, jacket water, oils, hydraulic fluids, oil lubricating systems and coolants is illustrated.



The unit consists of a casing containing tubes through which the hot liquid passes. A spray system drenches the tubes constantly with circulated water and air is drawn through the sprayed coils by a fan, applying the principle of evaporative cooling. Only the water evaporated is consumed, saving 95% of the water ordinarily used with shell and tube heat exchangers.

Osborn Manufacturing Co.
Cleveland, O.

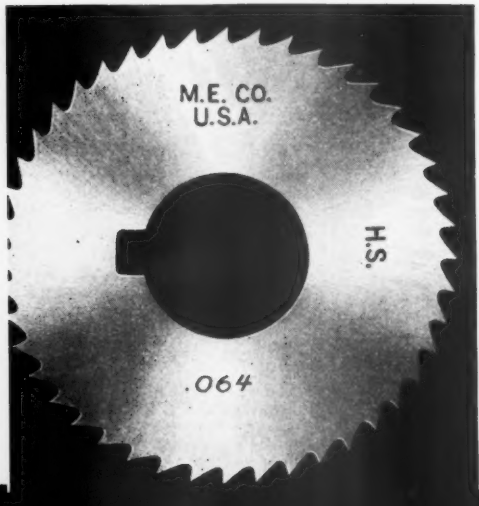
THIS company, world's largest manufacturer of industrial brushes, disclosed that industrial power brushes, carefully adapted to each job, are making some striking efficiency and time-saving records in the Nation's war production. The growing importance of power brushes as machine tools, and, in many instances, tools for precision operations, was emphasized.

Osborn brushes range in size from that of the little finger to a giant 22 feet long and 2 feet in diameter. In the exhibit was a brush specially designed to remove the coating of zinc chromate from around the rivet holes in airplanes to permit bonding. One airplane manufacturer reported that the brush increased the speed of this operation 100 percent.

One of the latest Osborn brushes was developed to remove rough edges from bomb sights. It is made of Nylon fiber only 2/1000 of an inch in diameter.

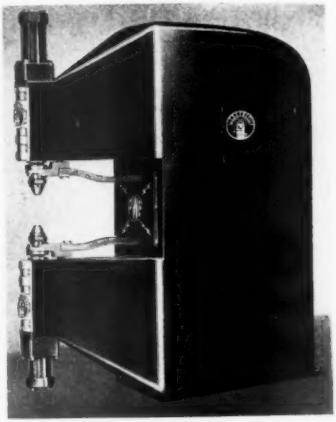
Martindale Electric Co.
Cleveland, O.

MARTINDALE Electric has had many years experience in the manufacture of Mica Saws and Cutters. As a result of this experience they have recently entered into production of screw slotting, metal slitting and copper notching saws, made in diameters up to 3". In addition, light weight dust masks, rotary files and burs will be exhibited in operation.



Progressive Welder Company
Detroit, Mich.

EXHIBITED for the first time, the spectacular new Temp-A-Trol welder, "the machine that thinks for itself," was designed for the welding of heavy sections of alloy steels.



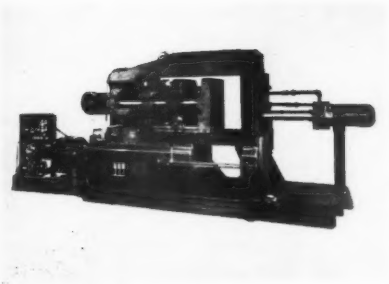
The machine, now in quantity production, departs radically in operation from conventional spot welding practice in that the temperature at the weld is used to control the machine rather than the customary cut-and-try regulation of current and time.

The second important feature made possible by this device is that the weld itself and adjacent areas can be heat treated and tempered immediately after welding without removing the part from between the electrodes.

Lester-Phoenix Machine Co.
Cleveland, O.

THIS Special Die Casting Machine produces non-porous castings of aluminum or brass weighing up to 10 pounds and magnesium of like displacement. A hydraulic oil pressure of 2000 psi actuates the injection plunger piston providing a casting pressure of 22,000 psi. The hydraulic pumps and motor are of sufficient capacity that a nitrogen accumulator system is usually not required. It can be supplied, however, if desired.

For short runs, such as aircraft parts,



the series 3 is furnished with manual control for the die movement and injection cycle. For long runs three safety interlocked electric timers are supplied for the exact repetition and control of die movement and injection cycle—to the tenth of a second.

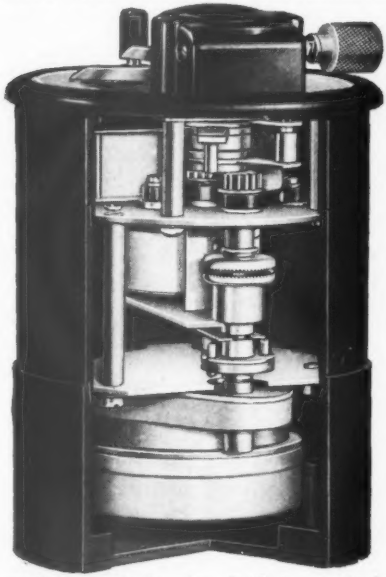
Continental Machines, Inc.
Minneapolis, Minn.

MODELS (exact replicas) of DoAll Contour Sawing and Filing Machines were exhibited this year so as not to interrupt the flow of these vital machine tools to plants engaged in war production.

Each model shows the latest features of construction and design, which have improved operation and increased the capacity of DoAll Machines. DoAll Precision Surface Grinders, Continental Band Filers and Contour Saw Bands and File Bands were also shown.

The R. W. Cramer Co., Inc.
Centerbrook, Conn.

FOR time controlled heating processes, such as hardening of tools and for complicated industrial processes, the sequences of which must be accurately timed, The R. W. Cramer Company, Inc., manufacture a variety of industrial automatic electric timers. The Type TD1C Time Delay Switch illustrated is



used extensively for built-in controls requiring short and accurate time delays for machine operations.

The Kelley-Koett Mfg. Co., Inc.
Covington, Ky.

THE Keleket Radiographic and Diffraction Unit is designed primarily for studying thin metal sheets, but it incorporates the added advantage of low kilovoltage for diffraction analysis.

Through the use of micro-radiography, many new facts about the reaction of

thin metals during spot-welding or machining, have been revealed. As a result, spot welding technique has been improved, until now it replaces riveting in many war production applications.

The patterns obtained by diffraction of metals and alloys yield additional information when analyzed.

CARBORUNDUM CO., NIAGARA FALLS, N. Y.—Exhibited centerless wheels, crank wheels, cut-off wheels, tool room wheels, thread grinding wheels and Trutex wheels MX. Also, fibre back and slotted discs, Nolap bands, abrasive belts and cartridge rolls.

DARWIN AND MILNER, CLEVELAND, O.—Information on modern quantity production steels of the high carbon, high chromium type was given.

FEDERAL PRODUCTS CORP., PROVIDENCE, R. I.—A wide range of precision measuring instruments displayed.

FIRTH-STERLING STEEL CO., McKEESPORT, PA.—Firthite "Hyper-Mills" (see page 154), other Firthite tools, high speed steel tools and Firthaloy sintered-carbide dies and mandrels were displayed.

HANDY AND HARMAN, NEW YORK, N. Y.—Displayed and demonstrated the low temperature silver brazing alloys, Sil-Fos, Easy-Flo and Handy-Flux.

HEIL AND COMPANY, CLEVELAND, O.—Chemical resistant tank and tank heating units adapted for pickling, cleaning, anodizing and hard chrome plating of metals.

INSTRUMENT SPECIALTIES CO., INC., LITTLE FALLS, N. Y.—The first public showing of the automatic recording drift micrometer sensitive to a millionth of an inch.

MAGNAFLUX CORP., CHICAGO, ILL.—Zyglo inspection method for locating defects in non-magnetic materials. Also the standard Magnaflux inspection unit demonstrating the new Magnaglo fluorescent inspection method for magnetic materials.

NORTON COMPANY, WORCESTER, MASS.—Grinding wheels and other abrasive products. The display emphasized the practicability of salvaging small tools. Also called attention to the advantages of using a finer wheel to produce a high finish when sharpening valuable tools.

PANGBORN CORP., HAGERSTOWN, MD.—Blast cleaning and dust control equipment. Latest information regarding speed cleaning of all metal parts entering into the manufacture of war products.

GEORGE SCHERR CO., NEW YORK, N. Y.—Exhibited the Wilder contour measuring projector, Scherr precision amplifying gage "Comparitol," Gaertner tool maker microscope, line of Atlantic adjustable snap gages, line of Reed micrometers, Scherr illuminated magnifiers "Magni-Ray," Scherr "Ultra-Chex" gage blocks and "Magne-Blox" magnetic chuck adapters.

RANSOME CONCRETE MACHINERY CO., DUNELLEN, N. J.—Exhibited a 2500-pound, a 3-ton and a 20-ton Welding Positioner in operation.

VASCOLOY-RAMET CO., CHICAGO. ILL.—Representative Tantalum Tungsten carbide cutting tools, drawing and extrusion dies, Tantung cutting tools and Tungsten electrodes for atomic-hydrogen welding were displayed.

Like hundreds of other plant items, even the best chucks—or anything else for that matter—wear out *some* time.

If new stocks are scarce and your want is immediate, you "need a friend" in a big hurry. *Here he is,* all set to give you the help you need—just call the Representative of your nearby Industrial Supply Distributor. For, even if *he* hasn't any in stock, he is almost sure to know many possible sources that may be closed to you. So when he says "don't worry—we'll scout up an emergency supply for you if there's any in town," you can be sure he will make every effort to keep you going. And usually he will *succeed.*

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

It's good business to take your own Distributors into your confidence and use them all the time. We know, because for many years they have been *our* Sales Representatives on Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout Industrial America.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 BEADE ST. NEW YORK. 9 NORTH JEFFERSON ST. CHICAGO 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD. DETROIT LONDON - E. P. BARRUS, LTD. - 35-36- 37 UPPER THAMES ST. E.C.4

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

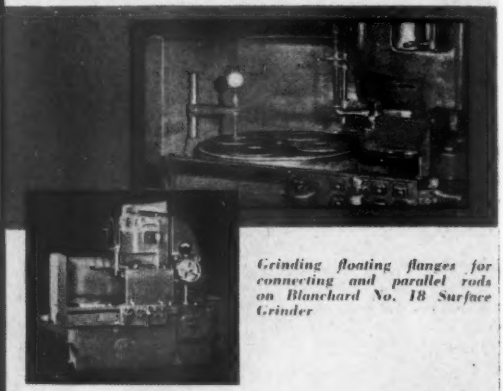
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
Adaptability
Fixture Saving
Operation Saving
★ Material Saving
Fine Finish
Flatness
Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

"PUT IT ON THE BLANCHARD"



Grinding floating flanges for connecting and parallel rods on Blanchard No. 18 Surface Grinder

THE Blanchard No. 18 Surface Grinder, shown above, is used for odd lot jobs in one of this country's leading railway shops. Other jobs up to 36" in diameter are also ground on this machine.

The job shown is boiler steel floating flanges for connecting and parallel rods. 1/32" of stock is removed from both sides to limits of .002" for flatness. 37 pieces (72 surfaces) are produced per hour.

These odd lots are ground at a profit on the Blanchard No. 18 because the set-ups may be changed quickly—the required limits and finish are easily maintained and held—and maximum production is obtained.

The BLANCHARD
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

Precision in time and space

Brush Direct Inking Oscillographs accurately and immediately record timing, strains, vibrations, pressure fluctuations—to 120 cycles per second.

The Brush Surface Analyzer instantaneously charts surface finish irregularities to a millionth of an inch.

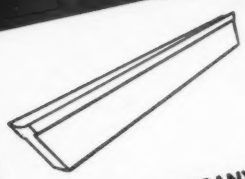
BRUSH
Crystal Products

On Display-Booth B142
National Metal Show
Write for Technical Bulletins

The
BRUSH DEVELOPMENT COMPANY
3311 Perkins Avenue
CLEVELAND, OHIO

Two things YOU SHOULD KNOW

THIS



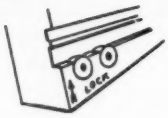
EMPIRE TOOL COMPANY'S
LUERS PATENTED
CUTTING-OFF

BLADES

You should know these blades because they have so many advantages over the ordinary type of cut-off blades. (1) Their distinctive T-shape provides exceptional side clearance, (2) the hollow-ground top allows free escape of the chip, and (3) the continuous longitudinal taper maintains a constant back clearance regardless of repeated sharpenings. Thus, excessive friction, which is the greatest cause of breakdowns, is eliminated.

Blades, both tapered and parallel in the longitudinal cutting width, carried in stock

and THIS



EMPIRE TOOL COMPANY'S
LUERS PATENTED
CUTTING-OFF TOOL

HOLDERS

You should know these tool holders for their unusual features in facilitating and speeding cutting-off operations. Aside from accommodating the Luers Blades, they possess these unique advantages: (1) will hold blade with bull-dog grip by virtue of the specially-designed, double-cam lock, (2) provide speedy and simple set-up of blade, (3) permit quick removal of blade alone for resharpening, without disturbing set-up, (4) admit quick replacement of blade accurately to original position, (5) made for all standard hand and automatic screw machines.

. . . TO SPEED YOUR CUTTING-OFF OPERATIONS

PRODUCED UNDER LICENSE ISSUED BY JOHN DILTON LUERS PATENTS, INC.

The Blades That Reduce Friction

EMPIRE Tool Co.

8700 Grinnell Ave.
Detroit, Mich.

SHIRT-SLEEVE *Trouble Shooters!*

We're up to our necks in trouble these days — that is, other companies' troubles! We've made *their* war production problems *our* problems, and are helping to solve them with a speed and efficiency born of long experience.

Sometimes this involves designing special jigs, fixtures, dies or machinery — sometimes rearranging plant layout and routing.

But whatever the requirements, skilled McKinney men — engineers, designers and tool makers — team their abilities and experience to effect maximum production in record time.

Our recently expanded facilities and increased personnel now enable us to offer this helpful engineering service to more companies. May we quote on your requirements?

DEPEND UPON McKINNEY FOR:

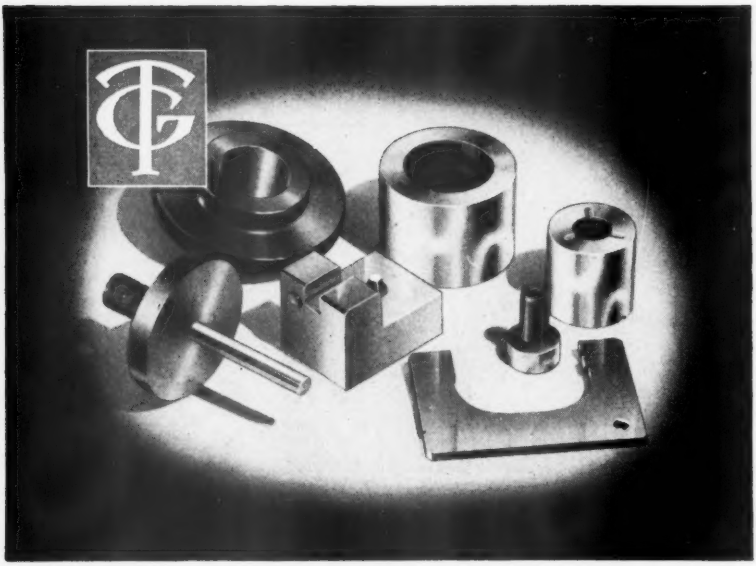
- ★ Design and manufacture of dies, jigs, fixtures
- ★ Process Engineering
- ★ Tool Designing
- ★ Plant Layout and Routing
- ★ Product Engineering
- ★ Machine Designing

McKINNEY

TOOL & MANUFACTURING CO.

1688 ARABELLA RD. CLEVELAND, OHIO

"DESIGN ENGINEERS FOR TWENTY YEARS"



TURNER

A Name to Remember

for

PRECISION GAUGES

For snap, ring, plug, flush pin and special gauges, Turner is the name to remember.

TURNER GAUGE GRINDING COMPANY

2624 HILTON ROAD • • • • FERNDALE, MICH.

VERNON

VERNON
NO. 0 PRECISION
HORIZONTAL MILL

VERNON
VERTICAL MILL
AND JIG BORER

SIMPLICITY
Because all Vernons are simply designed, new help finds them easy to operate, quickly bringing production to peak machine capacity.

EFFICIENCY
Compact design saves valuable floor space. Low consumption power plants drive through heavy cuts. Modern drives provide wide speed range, and quick changes.

SAFETY
All Vernons are designed with safety in mind. Fully enclosed drives prevent injury from open belts and pulleys.

★ Bulletins are available on each Vernon tool, write today!

VERNON
11" PRECISION
SHAPER

VERNON
12" PRECISION
Heavy Duty
Back-Geared
SHAPER

See the VERNON LINE—Dealers in all important industrial areas. Deliveries are being made Promptly!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON — LOS ANGELES, CALIFORNIA

Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

The American Industries Salvage Committee urges 100% participation by every member of the Metal Working Industry in the Salvage Program.

Get in the Scrap

A SALVAGE program in a plant, factory, shop or yard, must be based on the fact that industrial salvage and conservation form the backbone of the War Production Board's campaign to put the nation's waste back into production. Unless American industries take on the major job of making broken down, dismantled or unusable materials available for scrap, the national supply of steel for manufacture of war equipment will be endangered. For, if steel mills are not assured of an adequate supply of scrap, they cannot continue to keep production of the steel which goes into planes, tanks, guns and ships we need to win the war.

Such factors as type of work and the size of plant partially govern the organization of a company's salvage operations. But common methods of organization of a scrap campaign, collection, segregation and disposal, are available to all.

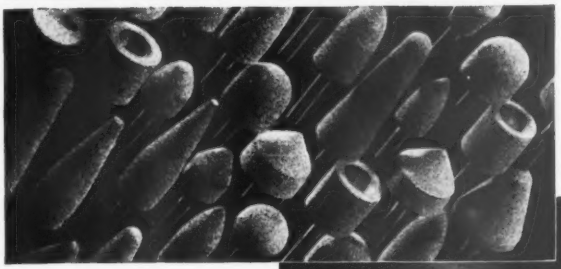
First, the organization to operate an effective salvage collection need not be elaborate or costly. It works best when it is simple and unencumbered with extra officials and unnecessary steps. An able executive of the company should head it up as Salvage Manager. He should work with superintendents and foremen in various departments. He must be armed with ample authority to make decisions to scrap unused material.

To start the ball rolling, these men should make a survey of their departments and report to the Salvage Manager machines and equipment which are obsolete or out of active production. The Salvage Manager should make a written report of these findings, as a basis for action.

It is management's function to mark and send to the scrap heap equipment that is obsolete. After inspection, use this yardstick in coming to a decision: If a machine or other piece of equipment hasn't been used for three months, and if it can't be proved that it will be used in the next three, turn it over where it can be used . . . or scrap it. Either dispose of equipment in industry if there is a call for it, or put it to work as scrap for the weapons of war.

Once such equipment has been marked for scrap, a responsible shop man should supervise its dismantling and classification. The assortment may be made to yield valuable replacement parts for machines in operation. Cutting down the need for purchasing new parts will remove the plant from the competition for equipment.

POLISH 'EM OFF WITH



They're TOUGH *and* DO Their STUFF!

Commandos of the grinding wheel industry—the first small wheels mounted on steel shanks and leading the way today with smoother, more rapid grinding, polishing and finishing of difficult jobs.

Chicago Mounted Wheels—the result of 45 years of KNOW HOW—come in a wide range of styles on different size shanks, for use with any portable or flexible shaft grinder. Several special-formula abrasives give 150% to 300% longer service. More than 200 shapes, all mounted and rarin' to go.

HI-POWER GRINDER

A real production tool — a 3-pounder with enough power to drive a 2½" diameter wheel. 17,000 r. p. m. In case with accessories, $38.50.

LATEST CATALOG—Packed full of comprehensive information and pictures. You'll be interested. Send for copy.

TEST WHEEL FREE

If you have a grinding problem, send for a Survey blank, which you'll find easy to fill out. Upon its return, our abrasive engineers will analyze it and send you without charge the trial wheel they recommend for your particular job.

TD-10

☐ Send Hi-Power ☐ Catalog
☐ Free Wheel. Size _____

Name _____

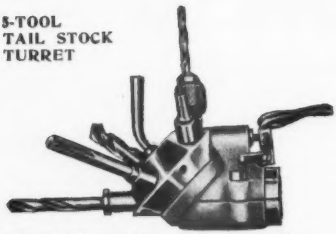
Address _____

CHICAGO WHEEL & MFG. CO.

Makers of Quality Products Since 1896

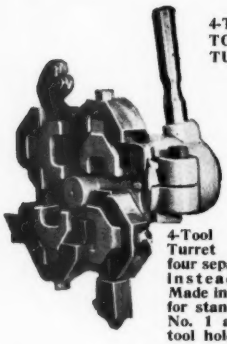
1101 W. Monroe St., Dept. TD, Chicago, Ill.

5-TOOL
TAIL STOCK
TURRET



5-Tool Tail-Stock Turret accommodates five tools and each tool centers automatically when brought into position by means of an indexing plunger. Made in four sizes to fit small bench lathes up to lathes with 24" swing.

4-TOOL
TOOL-POST
TURRET



4-Tool Tool-Post Turret carries four separate tools instead of one. Made in two sizes for standard 0, 00, No. 1 and No. 2 tool holders.

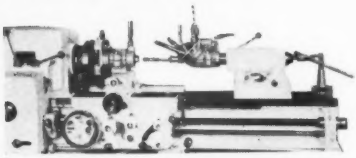
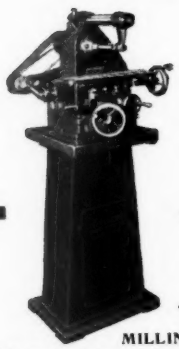


Photo above shows Jefferson Turret Attachments on 16" Engine Lathe.



"BULL DOG"
PRECISION
MILLING MACHINE

This motor driven power feed precision milling machine is capable of close tolerances on die sinking, contour profiling, angular milling, jig boring, routing of ferrous, non-ferrous metals, fibre and plastics for production line or toolroom. Has 4 spindle speeds: 200, 400, 700 and 1000 R.P.M.—Write for details.

ENGINE LATHE TO TURRET LATHE

in 15 seconds

Don't wait for Turret Lathes . . . You can convert any engine lathe into a complete precision turret lathe in 15 seconds with the Jefferson 4-Tool Tool-Post Turret, 5-Tool Tail-Stock Turret and Adjustable Pull Feed—and double its capacity. For forming, roughing, boring, finishing, drilling, tapping, etc.

Adjustable Pull Feed eliminates slow movement of tail-stock spindle and provides easy control. For any lathe up to 24" swing. Delivery, 15 Days. Write for Details.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

7 TIMES AS FAST WITH DoAll BAND FILES

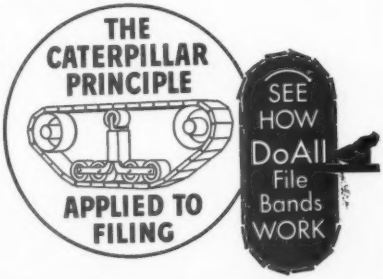
● Filing sheet steel parts for instrument cabinets and panels now speeded through with DoAll Band Files. Formerly done on nibbler and hand filed.

CONTINUOUS ONE-WAY STROKE

There's no stopping or back-stroking. Filing with a DoAll means steady, one-direction travel, with even pressure until the job is perfect. This caterpillar principle means you are cutting at maximum all the time.

Then—there are tremendous savings in file costs. For example, on a recent test, a DoAll Band was run at the rate of 100 feet per minute filing Ketos Steel held against the file by 25 pounds' pressure. The file band ran steadily for 125 hours before showing wear.

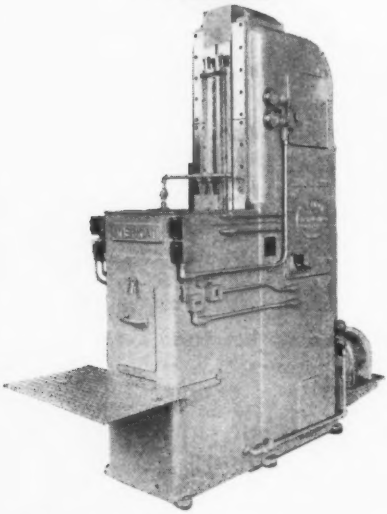
There's a wide range of styles, cuts and widths to take care of any kind of material. Send for new file Booklet, prices and discounts.



THE DOALL COMPANY
1203 Thacker St., DesPlaines, Illinois
Associated with Continental Machines, Inc., Minneapolis, Minn.

AMERICAN *Goes Over The* TOP

AMERICAN has gone "Over The Top" in supplying war manufacturers with suitable broaching equipment. We have supplied complete machines and tooling for rapid production of parts for planes, tanks, guns, ships, shells, trucks and bombsights. We have drawn upon every ounce of ingenuity and years of past experience in order to produce machines and tools which will give the utmost in production and satisfactory performance.

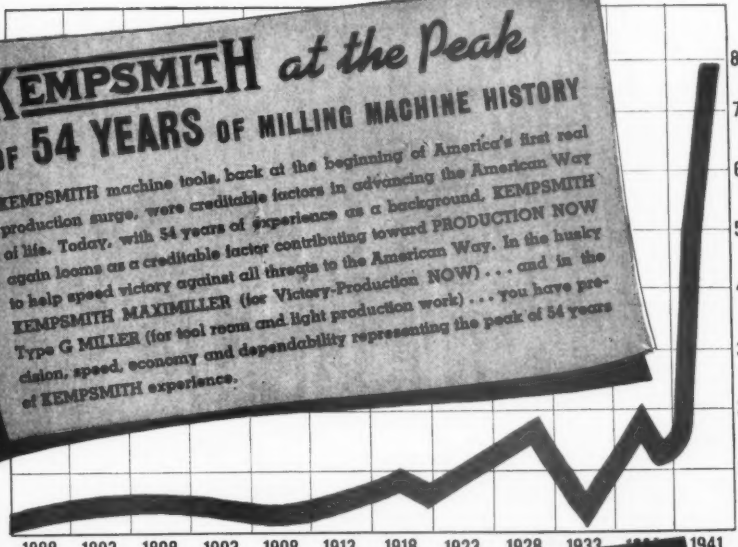


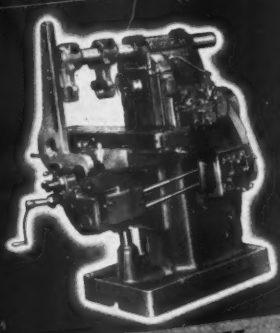
Shown to the left is an AMERICAN SB-42-5 ton single ram surface broaching machine arranged for broaching split line on aircraft bearings. This machine is provided with a special work table and the part is clamped by hydraulic pressure. High production is obtained.

AMERICAN BROACH & MACHINE COMPANY
ANN ARBOR, MICHIGAN, U. S. A.
BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY
Division of Sunstrand Machine Tool Co.

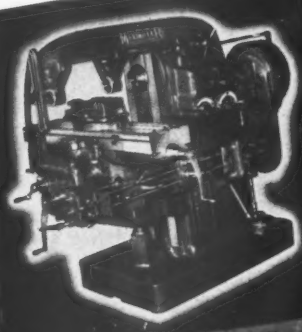
KEMPSMITH at the Peak
OF 54 YEARS OF MILLING MACHINE HISTORY

KEMPSMITH machine tools, back at the beginning of America's first real production surge, were creditable factors in advancing the American Way of life. Today, with 54 years of experience as a background, KEMPSMITH again looms as a creditable factor contributing toward PRODUCTION NOW to help speed victory against all threats to the American Way. In the husky KEMPSMITH MAXIMILLER (for Victory-Production NOW) . . . and in the Type G MILLER (for tool room and light production work) . . . you have precision, speed, economy and dependability representing the peak of 54 years of KEMPSMITH experience.





KEMPSMITH
TYPE "G" MILLER
. . . "brother" of the famous KEMPSMITH MAXIMILLER



KEMPSMITH
MAXIMILLER
. . . built to speed up production on "3-shift" schedules

PRECISION
MILLING MACHINERY
Experience SINCE 1888
KEMPSMITH MACHINE CO.
MILWAUKEE - WISCONSIN

American No. 2

PLAIN MILLING MACHINE

for
SPEED, ACCURACY AND VERSATILITY
in
ARMAMENT PRODUCTION

Infinite Spindle Speeds—25 to 500 r.p.m.

Standardized Spindle Nose. Spindle heat - treated chrome-nickel steel with No. 40 taper.

Motor in Base Drive. 3 hp U. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily proportioned column houses motor drive and power shafts.

PROMPT DELIVERY

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

Table working surface	46"x10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

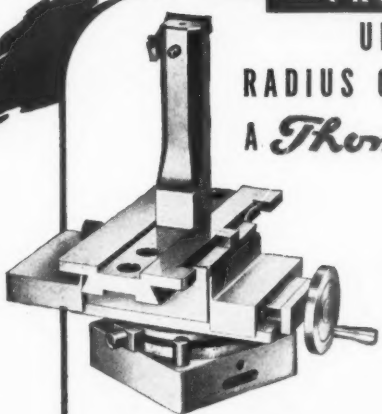
J. L. LUCAS & SON, INC.

BRIDGEPORT CONNECTICUT

A
FLEXIBLE NEW TOOL
TO SPEED

Vital

PRODUCTION
UNIVERSAL
RADIUS GRINDING DRESSER
A *Thompson* · PRODUCT



This Dresser will dress a radius on a wheel either concave or convex from 30 thousandths to 4 inches and do same accurately and efficiently.

The Dresser is set by gauge blocks eliminating any guess work.

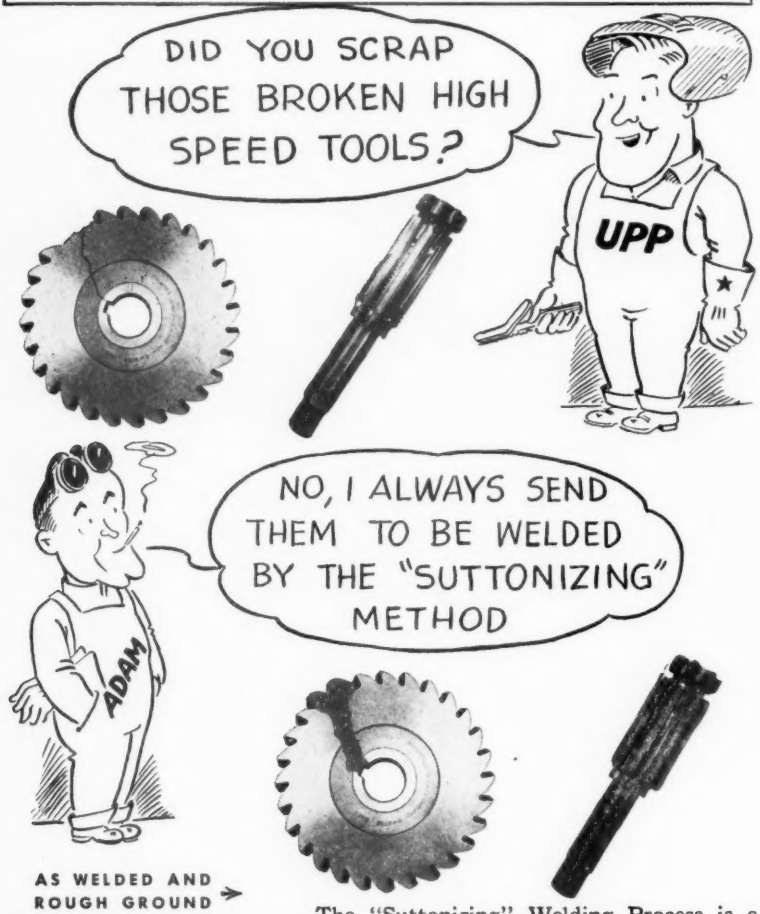
It will also dress any angles required on a wheel.

Also can be set for a radius and angle without changing the set up.

PATENT PENDING

AUTO-ORDNANCE
Corporation

UPP and ADAM *Broadcast No. 1001* • • *by* Mason-Hahn



AS WELDED AND ROUGH GROUND ➔

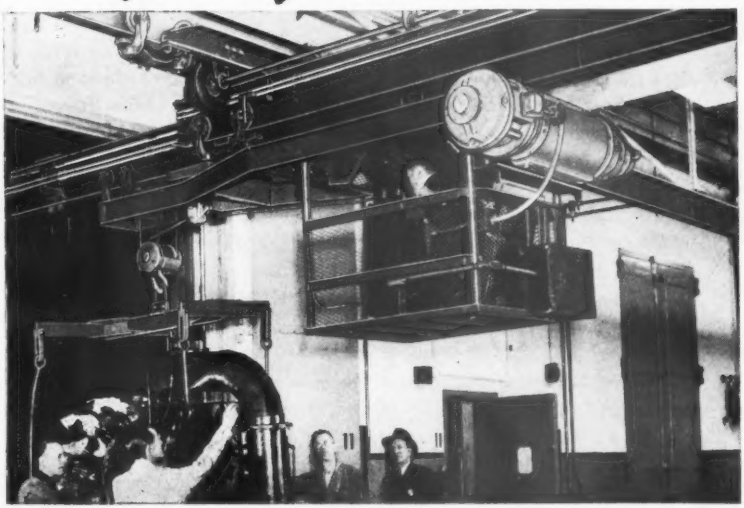
Wire or write for our catalog today—it shows you typical examples of tools that have been reclaimed by "Suttonizing" such as Reamers, Broaches, Taps, Form Cutters, Drills, Hobs, Lathe Centers, Turning Tools, End Mills, etc.

The "Suttonizing" Welding Process is a new method that can be applied only in our plant. Tools sent to us can be repaired and returned promptly without *post heat treatment* in the majority of cases. Why not take "Upp and Adam's" advice and send us your broken high speed tools, hundreds of others do and are well satisfied.

WELDING EQUIPMENT & SUPPLY CO.
226 Leib Street • DETROIT, MICHIGAN

"AIR CARGO"

in your plant, too!



Proven over the years by
AMERICAN MONORAIL EQUIPMENT

From raw materials to finished products, in every operation, American MonoRail Equipment is speeding up production in countless numbers of plants. There is no installation too large and none too small that will not increase production, reduce accidents, reduce employee fatigue, release skilled hands from handling jobs and result in savings of time and money.

American MonoRail Engineers will gladly show you how American MonoRail Equipment will do all these and more in your plant. Write today, no obligation.

WRITE FOR Blue Book illustrating hundreds of MonoRail installations.

THE AMERICAN MONORAIL CO.
13131 Athens Avenue **Cleveland, Ohio**

An Invitation to a
MACHINERY MANUFACTURER or INVENTOR

to plan with us NOW for an enlarged business AFTER THE WAR

We are one of the leading makers of machinery in our particular field. Our wrapping machines are now used by many hundreds of plants — in the food, drug, candy, tobacco, dairy fields, etc. Our engineering and designing staffs have first rate inventive ability and have been responsible for many outstanding improvements now widely used. Our plant is modern, and is manned by experienced and skilled craftsmen.

We are now heavily engaged in war work — both designing and manufacturing — and to give our best to this effort, have greatly enlarged our facilities. Consequently, we will be in a position to build a larger line of machinery when the war ends.

In preparation for this, we are now working on ideas for expanding our regular line of machines.

But we want to do more.

We are thinking of adding other lines of machines used by other industries.

- You may have ideas for new machinery which need development. We'll be glad to discuss them with you, and if mutually satisfactory, will develop them with you.
- You may have a machine or machines which you have been making in your own plant, but which you could make with greater profit in ours.

Our final arrangement may result in your coming into our company — or it may be worked out on some other desirable basis. Right now, we are thinking broadly with wide-open minds.

If you feel you have something on which we might work together, we suggest that you communicate with us, giving full particulars. We can then arrange for a meeting.

PACKAGE MACHINERY COMPANY, Springfield, Mass.

PLASTICATOR

GORDON B. THAYER*
Technical Consultant

CONSERVATION of the dwindling supply of industrial man-hours is an essential responsibility of the army of engineers at home. Men responsible for tooling must now draw on accumulated experiences if the utmost in production efficiency is to result. Difficulties in tool tryouts and in production runs must be anticipated in the drafting room and foresight must take the place of cut-and-try methods. By applying carefully proven principles, many man-hours of tryouts can be saved.

Some fundamental factors of plastics mold design are frequently taken so much for granted that their importance is liable to be overlooked. Yet one comparatively simple item, if neglected, may introduce mechanical difficulties which cannot be eliminated. Such a mold goes into production with an eventual output far below its potentialities, even though it may produce parts of acceptable quality.

"Loading the Injection Mold", the first of a series of articles scheduled to appear in the Plasticator, describes the details of modern injection mold design. This article discusses the sprue, sprue puller, cold slug well, runners and gates. Future articles will cover venting, cavity construction and ejector systems.

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By Don F. Hoffman
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Loading The Injection Mold

THE loading system of an injection mold has as its function the conveyance of the plastics material from the heater to the mold cavity in such a manner that the molded piece will be completely filled out; will be sound and strong; and will have the desired surface finish. To simplify discussion, the system may be divided into a number of elements. These elements are the sprue, sprue puller, cold slug well, runner, and gate, for the feeding system proper, and the venting arrangement which is often required to let air out of the mold as the plastics material comes in.

Careful attention to these elements, to be sure each one is designed in the light of the best experience, can do much to avoid unnecessary difficulties in mold tryouts and to insure against limping production rates.

The Sprue

The sprue is a round, tapered hole which leads the plastics material from the nozzle of the heating cylinder of the injection molding machine to the distributing runners in the mold. A typical sprue is shown in Fig. 1. The heater nozzle makes contact with the sprue bushing at the small end of the taper, against some sort of accurately fitting seat which in this diagram is shown to be spherical.

The diameter of the small end of the sprue should be .015" to .025" larger than the orifice at the end of the heater nozzle. This provides sufficient margin for possible variation in nozzle and mold alignment, so the portion of the sprue which breaks off inside the nozzle when the mold opens will not overhang the hole in the bushing and prevent free passage of the sprue through it. The size of the nozzle and sprue employed for a specific molding application should be in proportion to the size of the shot or charge of material required to fill the mold. Large sprues generally provide better flowing conditions than small sprues, and do no particular harm except to increase the amount of sprue scrap which must be reprocessed and used again.

A taper of 2°-30′ on a side is shown in the diagram. This is a practical

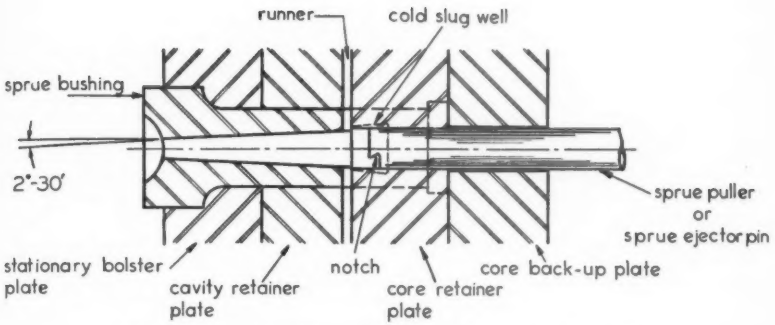


Fig. 1 — Sprue bushing, cold slug well and sprue puller

amount which will insure easy release of the sprue but which will not increase the diameter of the large end unduly for a long sprue. The taper should be reamed smoothly, without tool marks, and it should be polished. Rough sprues may cause losses of as much as 10 seconds in the molding cycle because of the extra time the molded material requires to cool and harden sufficiently to permit it to be pulled out of the rough hole. The use of a standard taper angle for all of the sprue bushings manufactured in a single shop makes it possible to use a single reamer for reaming a wide range of diameters and lengths.

The shoulder on the sprue bushing should be rather long, because there is possibility of encountering large shearing forces which tend to push the shank through the shoulder. A generous radius where the diameter changes avoids stress concentration and hardening cracks. A radius at the large end of the sprue, where it meets the runner, improves the flowing conditions for the plastics material.

Mold steel should be used in making the sprue bushing, because it should be hardened to 40-45 Rockwell C. This makes the bushing resistant to crushing and brinelling, and thus it helps in maintaining good seating of the nozzle, which prevents the molding material from leaking out at this junction. Also, lodged or stuck sprues may be hammered out with a rod of brass or other soft metal without damaging the seat or taper.

Sprue Puller and Cold Slug Well

The sprue puller is a round pin which is carried in the movable half of the injection mold, anchored in the ejector plates. Its function is to pull the sprues out of the bushing as the mold breaks open, and then to eject the sprue and cold slug as the ejector pins push the molding out of the mold. Two distinct styles of sprue pullers are in general use. One type is shown in Fig. 1 in full lines, and the other in broken lines. The former type is notched in order to hook the sprue and pull it out. The latter type has an undercut in the sprue ejector pin bushing to accomplish the same thing. The sprue puller, or the sprue ejector pin, is cut off below the parting surface of the mold in order to make room for the cold slug.

Generally the diameter of the sprue puller is $\frac{3}{8}$" to $\frac{7}{16}$" and it should have a slip-fit tolerance and a ground finish lapped into place. It should be hard in order to reduce wear and to slide freely in the plate. For long production runs many designers prefer to fit the sprue puller in a hardened bushing. This increases the useful life, which ends when the parts have become so worn that flash can run down the pin and cause it to bind in the hole.

When a hardened sprue puller or sprue ejector pin bushing is employed, it is desirable to make an undercut in

the bushing as shown by the broken lines in Fig. 1. Then the end of the sprue ejector pin is cut off squarely, without having a notch, below the undercut which is sufficiently deep to hold the sprue and pull it out but not deep enough to resist ejection when the pin moves forward.

Smooth operation may be obtained by running the pin through clearance holes, as shown in the core backing plate in Fig. 1, and by having a slip-fit for only a short distance, as shown in the core retainer plate or in the sprue ejector pin bushing.

The cold slug well is a trap for the first portion of the shot of plastics material to enter the mold. This material is likely to be chilled below good molding temperature because it has remained in the heater nozzle tip, which is difficult to keep hot, or has oozed out of it and cooled in air during the ejection part of the molding cycle. The cold material impairs the surface and physical properties of the molding, hence the trap to prevent its entering the mold cavity.

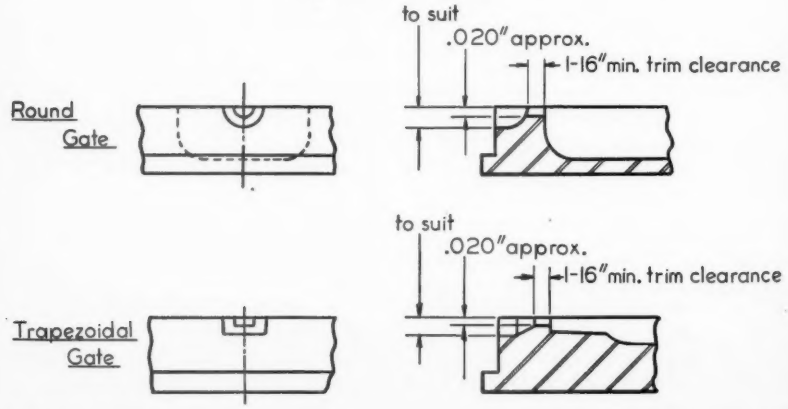
It is necessary to have space enough in the well to trap all of the cold material. Usually ½" diameter by ⅜" deep is sufficient. Two cold slug wells are shown in Fig. 1. The one shown in full lines is used with the notched pin and the one shown in broken lines is used with the square-end pin in the hardened steel sprue ejector pin bushing.

Runners and Gates

In an injection mold the runners are channels—preferably located in the movable half of the mold—which form a passage from the sprue to the gate of the cavity. The design of the runners should be such that sufficient material can be carried to the cavities quickly and with a minimum loss of injection pressure. This can be achieved by employing a favorable cross sectional area such as semi-circular or trapezoidal. For the tool maker, this requires a milling operation on the face of one side of the mold only. A high polish is not usually necessary although tool marks should be removed. The length of the runners should be as short as possible to reduce friction losses and runner scrap which has to be reprocessed and used again. To maintain sprue and runner loss below 15 percent of the complete shot is good practice, although the size of the molded article, the number of pieces per shot, and the physical properties and characteristics of the material are factors which may alter this desirable ratio.

Designers generally try to engineer multiple cavity injection molds in such a manner that all of the cavities are identical, thus reducing difficulties in runner and gate dimensional requirements. However, it is sometimes necessary to mold two or more different pieces in the same multiple cavity mold. Then it is difficult to fill each of the different

Fig. 2 — Plain Gates



cavities evenly because the resistance in the cavities is not uniform. The size of the runners may then be varied to equalize the resistance to uniform flowing and thus to allow the cavities to fill equally.

The gate of an injection mold is the section of the runner immediately adjacent to the mold cavity. It may have the same shape as the runner, or it may

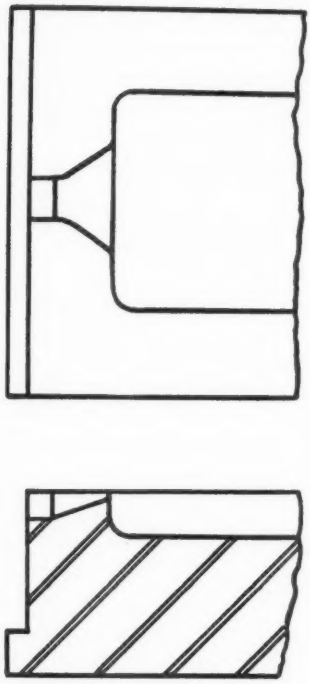


Fig. 3 — Fan Type Gate

be fan-shaped—a ring all around the cavity or a disc inside a ring-shaped cavity. The size, shape and location of the gate are often critical factors in the mold design. Small gates have long been preferred because they require the least number of trimming and finishing operations. However, other requirements have been introduced by new materials and the need to mold heavy or uneven sections. Heavy sections of crystal clear materials are now molded through extremely large gates without encountering shrinks or bubbles. Some molding materials mold best through thin gates which force the material to striate or laminate, while others require thick gates to avoid striations and strains. Many factors influence the location of a gate. Concealment is one, and prominence for easy removal is another. Location for best flowing conditions around cores and for placing weld lines near natural vents or away from stressed portions are others.

The gating required should be given careful attention before making the mold layout so that the cavity design and gating can proceed together.

In Fig. 2 are shown two styles of plain gates. Some designers prefer the round shape, while others prefer the trapezoidal which seems to provide less resistance to flow. The plain gate is useful for general work where cores or other obstructions in the mold cavity do not interfere insurmountably with filling the mold or when weld strength or direction of flow in the cavity are not critical. For heavy sections or turbulent flow conditions a variation of the plain gate may be used. This is called a fan gate, and it is shown in Fig. 3. The fan gate reduces the velocity of the entering plastics material by making the gate area larger than the runner area in applications where turbulent flow traps bubbles of air before they can escape from the mold cavity. Also, reducing the velocity of flow may give the air in the mold a slightly longer time to escape through the vents and thus burning due to rapid compression of the last air in the mold is prevented.

The fan gate also distributes the entering material more widely than does the plain gate and thus it does away with striations which are undesirable for certain materials, particularly those which are transparent, or are weak along the planes of the striations. When it is desired to load a large cavity from a heavy runner and still force the material to flow in thin layers, or laminations, a fan gate may be used. It should be thinner than the runner, and wide enough to retain as much area as the runner.

PLASTICATOR

By S. A. Rulon
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Machining of Phenolic Laminate

UNDER present wartime conditions many manufacturers are faced with the necessity of working with unfamiliar materials. A factory which produced tooth brushes is now converted for the manufacture of pumps for life rafts, another has changed its product from harness to antennae masts; and these are by no means isolated examples. In consequence, the new problems encountered are many, and not the least of these is the difficulty of machining various materials with which the manufacturer may have had no previous experience.

One of these materials, which is finding ever-increasing use in the production of war materials, is phenolic laminate. This extremely useful product has been standard for many years and its properties are well known to the electrical industry. However, with so many new users as now exist, it is obvious that the best practices for machining will not necessarily always be known—or followed. A description of these methods may well be of considerable interest and usefulness not only to those who are encountering laminate for the first time but perhaps even to those who have already had some experience in this field.

Phenolic laminate is manufactured by impregnating various sheet materials such as paper, cotton, fabric, asbestos, or glass fabric with a thermosetting synthetic resin of the phenol formaldehyde type. Cut into convenient sizes, these sheets are stacked and pressed under high temperatures and pressures to form a consolidated material with high mechanical strength and excellent dielectric properties. Laminate may also be produced in the form of rods or tubes.

A number of standard grades are available, each with its own range of applications, as well as special grades designed to meet particular problems. The Standard Grades are described by the National Electrical Manufacturers' Association in their standard LP2-14. Further details concerning these grades, including representative values for their mechanical and electrical values, may be found in N.E.M.A. Publication 39-57.

Designing

As with any material, there are certain machining practices which are best when handling phenolic laminate. It is important to bear in mind that we are

Shearing

dealing with a laminated material, and the direction of the laminations determines the strength of the finished parts and the ease of machining. As a general rule, sheets are cheaper than rods or tubes, and are more economical to use where practical. It is not economical to cut discs from rods, nor washers from tubes if the less expensive sheet material can be used.

It is better to drill and tap holes in sheets through the thickness rather than parallel to the laminations. The material may tend to split in the latter case if the tools are dull or are forced too much. If used for friction purposes, as in rubbing blocks, loom parts, rollers, etc., the wear should come across the laminations and not parallel to them. A roller made from a disc cut from sheet stock will outlast fifty rollers cut from a tube.

Shearing

Thin sheets can be sheared on ordinary hand shears as used for cardboard. Heavier sheets can be sheared on power operated guillotine type shears as used for cutting steel. Large quantities of thin strips may be quickly and accurately cut on standard slitting machines.

Grade XP is readily sheared cold up to and including $\frac{1}{16}$" thick. Other grades may be sheared cold not exceeding $\frac{3}{64}$" thick. Heating to 120° F. will facilitate shearing thicker sheets. Higher temperature may be used but in no case should it exceed 250° F. Do not allow the material to remain on the hot plate for more than one or two minutes. If the hot plate gets too warm it may be covered with asbestos sheets to protect the laminate.

Sawing

Bandsawing is satisfactory where close tolerances or smooth edges are not important. Saws should be tempered to permit frequent sharpening by filing. More set is required for sawing discs than for sawing strips or blocks. The following specifications are recommended for band saw practice:

		Band Saw Specifications		
Type of Part	Speed FPM	Width Inches	Thickness Inches	No. Points Per Inch
Scroll	4000 to 5000	¼-⅜	.037	6
Discs up to 5"	4000 to 5000	¼-⅜	.037	6
Discs over 5"	4000 to 5000	½	.037	5
Strips and Blocks	4000 to 5000	1¼-1½	.042	5

When smooth edges are required or close tolerances are important a hollow-ground circular saw without set should be used. It is important to keep saws sharp because dull saws cause chipping. Sharp saws set too high or too low on the table will also cause chipping. Softer saws, which can be filed, are more satisfactory than hard saws requiring grinding. It is important that the teeth be square, all of the same height and have sharp edges without burrs. The cutting edge should run directly toward or slightly back of the center hole. The following specifications are recommended for circular saw practice:

		Circular Saw Specifications		
Material	Speed RPM	Diameter In.	Thickness In.	Teeth Per In.
Sheet—$\frac{1}{16}$" thick	2500 to 3000	10	$\frac{1}{8}$	6
Sheet—$\frac{1}{8}$" thick	2500 to 3000	14	$\frac{3}{16}$	4
Sheet—¼" upward	2500 to 3000	14	$\frac{1}{8}$	4
Tubing—Under 1" OD	2500 to 3000	15	$\frac{1}{8}$	8
Tubing—Over 1" OD	2500 to 3000	17	$\frac{3}{16}$	5

In either bandsawing or circular sawing, feed work as rapidly as possible without forcing.

Punching

For punching, the same rules may be followed as in punching metal, except it is more important that punches and

strippers fit closely. Compression stripper plates are highly recommended. While progressive dies may in most cases prove satisfactory, best results are obtained from compound dies built to place compression on the stripper.

Grades C, L and XP may be punched up to $\frac{3}{32}$" thick without heating. Above this thickness heating the material to from 180° F. to 250° F. will greatly facilitate punching. Never heat it over 250° F. or leave it on the hot plate for more than one or two minutes.

Dies for punching should not have any taper clearance due to the necessity for frequent grinding. When working to close tolerances make piercing punches .002" to .003" larger for each $\frac{1}{32}$" in thickness to allow for material shrinkage. Blanking punches should be .001" to .008" smaller than the size of the required blank.

Horn dies are used for punching tubes. The tube should be a close fit over the barrel and where holes are close or wall thickness is over $\frac{1}{32}$", heating is recommended.

In good punching practice, the edges of the piece should not be closer to the edge of the strip than twice the thickness of the sheet; the holes should not be smaller in diameter than the thickness of the sheet nor have square corners; the distance between holes or between holes and edge of piece should not be less than the thickness of the sheet.

Heating the material to a temperature of 180° to 250° F. is generally necessary for best punching results, although in some grades this may make the material too soft. In this case, better results may be obtained by heating at lower temperatures or for a shorter time. If more than 2 minutes elapse between the time the strip leaves the heating medium and the last piece is punched, results will be poor.

Shaving

Where especially smooth edges are required on punched pieces, they can be shaved with hollow smooth shaving dies after the pieces have been rough punched. The cutting edge of the die should have a 45° bevel and should not be too sharp. Shave off $\frac{1}{16}$" to $\frac{1}{8}$" of material at each stroke of the press. Heating the laminate will facilitate shaving.

Punching

Machining

In machining phenolic laminate, practically the same rules apply as in machining brass. Use the highest possible speeds and keep tools sharp. Slow speeds will not only curtail production, but will make tools dull rapidly.

The cemented tungsten carbide tool tips such as Carboloy, are especially recommended for turning and boring. Small tips can be purchased for a nominal price and can easily be brazed to a metal holder. By taking advantage of the high speeds available in most modern machine tools, the use of these tool tips will often increase production 25% to 50%.

Milling

Standard machines and cutters are used, but higher speeds and feeds than used for metals will give best results. For deep slots use side milling cutters, with the tool cutting downward. Single

(Continued on Page 142)

Shaving

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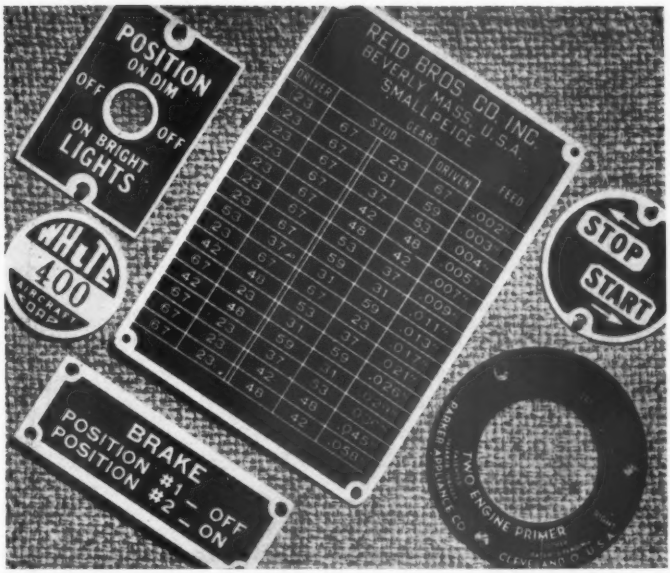

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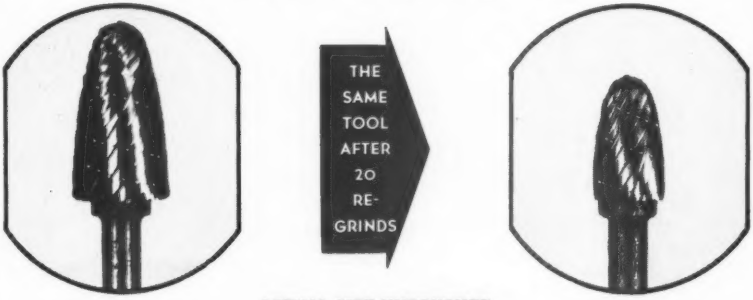

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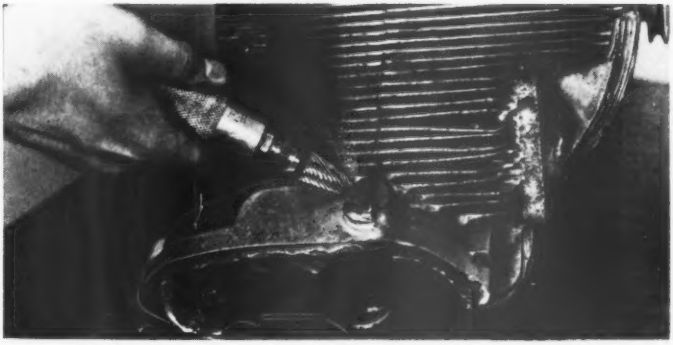

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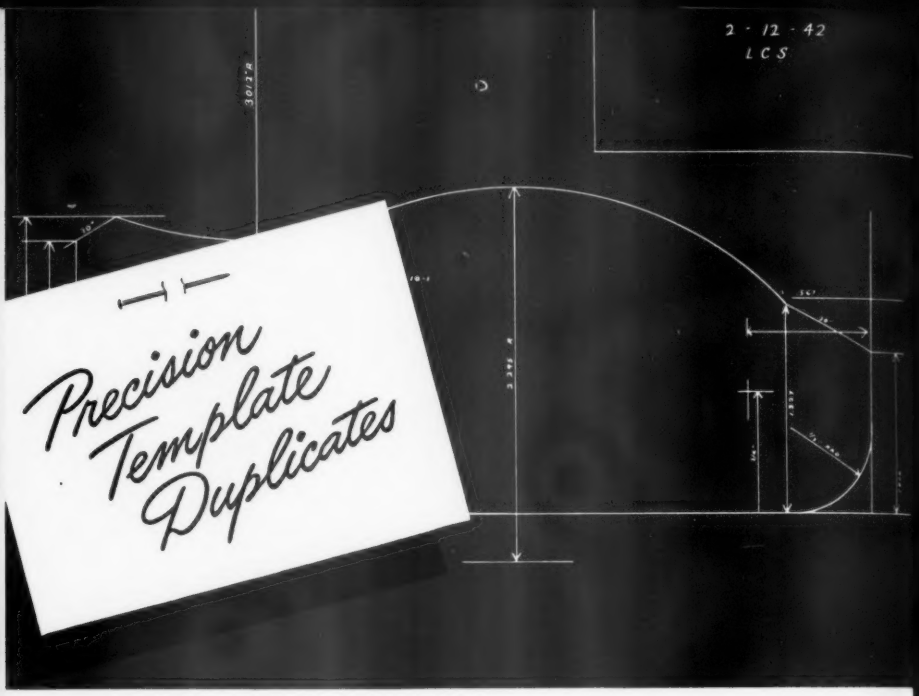

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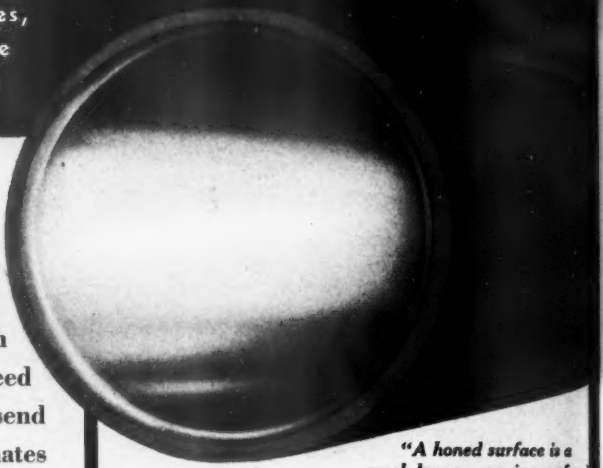

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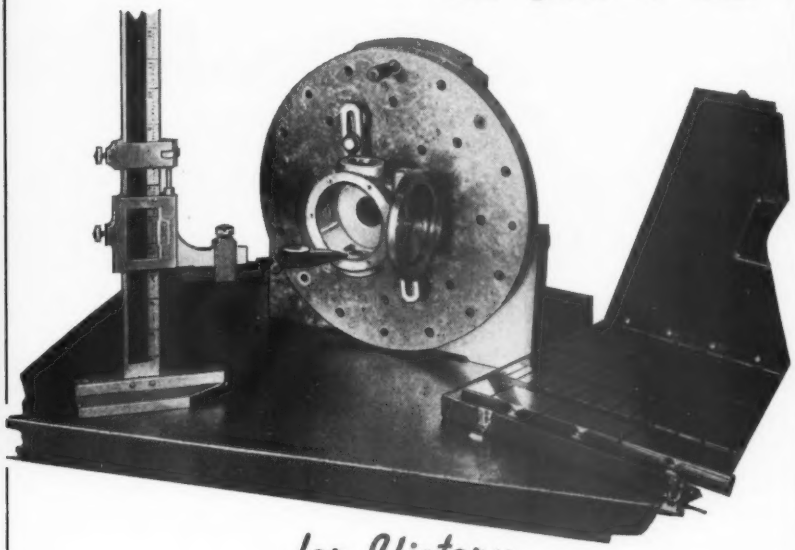

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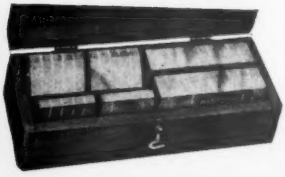

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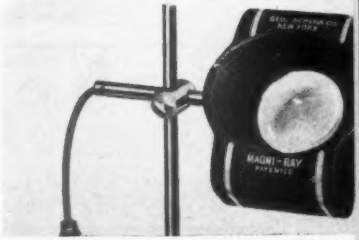


Write for illustrated folders on the above tools

128-B LAFAYETTE STREET
NEW YORK, N. Y.

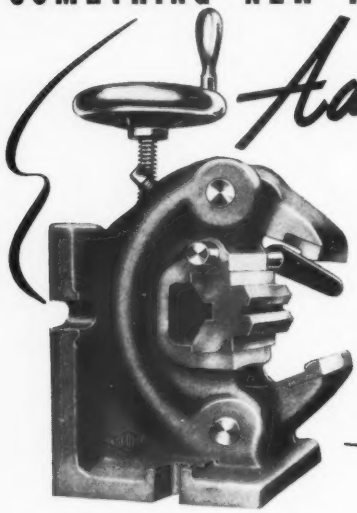
ACCURACY

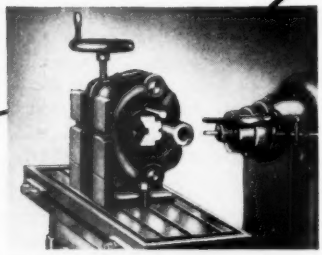
SOMETHING NEW HAS BEEN

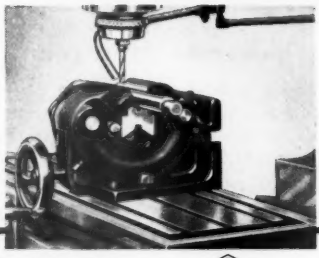
Added . . .

TO THE LINE OF

PRODUCTO MODERN MACHINE VISES . . . .







Self-Centering Shaft Vise

An entirely new idea in Vise construction in this Country. For machining keyways and slots in shafts or spindles — range of sizes 3/8" to 3 1/8" diameter — suitable for vertical or horizontal mounting. Setting of Vise remains unaltered for all work diameters and insures accurate radial cuts. Shafts correctly located in V jaw by equal movement of two jaws. Hardened V jaw reversible in Vise.

Size of Base 8" x 7 1/4" — Approximate weight 80 lbs.

Write for circular

The PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVENUE
BRIDGEPORT, CONNECTICUT

3017 MEDBURY AVENUE
DETROIT, MICHIGAN

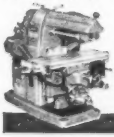
A battery of Atlas Lathes equipped for screw machine operations helps [redacted] meet delivery schedules on a wide variety of precision airplane control units.

SAVE PRECIOUS MINUTES . . . .

There is one sure way to by-pass the screw machine shortage on small parts production—use Atlas 10" Lathes with turrets and collet chuck. Equipment cost is low. Atlas Lathes have the rigidity and accuracy for today's precision tolerances and can take round-the-clock production runs month after month. We hope every manufacturer faced with shortages in screw machine and turning production will investigate the possibilities of Atlas Lathes. Atlas Press Company, 1012 N. Pitcher St., Kalamazoo, Michigan.

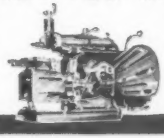
Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH.
U.S.A.

OTHER ATLAS EQUIPMENT FOR WAR PRODUCTION



MILLING MACHINES
Compact, powerful bench millers for full range of milling work.

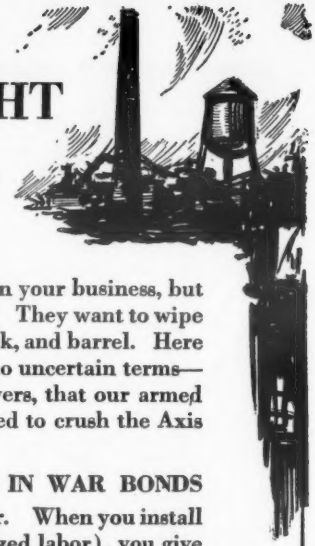
SHAPERS
Handle all work within a 7" stroke accurately, quickly.



DRILLING MACHINES
Step up production on small-hole drilling, tapping, 4, 3, 2-spindle models.

TARGET FOR TONIGHT

. . . *Your Business?*



Maybe they won't actually come and drop a *bomb* on your business, but the Axis war lords have their eye on it, just the same. They want to wipe it out as a competitive force—or take it over lock, stock, and barrel. Here is a threat that you can reply to *now*, today, and in no uncertain terms—by buying War Bonds to the very limit of your powers, that our armed forces may have the guns, tanks, and planes they need to crush the Axis *once and for all.*

THE GOAL: 10% OF EVERYONE'S INCOME IN WAR BONDS

Every American wants the chance to help win this war. When you install the Pay-Roll War Savings Plan (approved by organized labor), you give your employees that chance. For details of the plan, which provides for the systematic purchase of War Bonds by voluntary pay-roll allotments, write: Treasury Department, Section S, 709 12th St. NW., Washington, D. C.

EVERYBODY EVERY PAYDAY 10%

Buy War Savings Bonds

This space is a contribution to America's All-Out War Program by

Staff of The TOOL & DIE Journal

SIMPLIFIED CONTROL

MEETS THE URGENT DEMAND FOR INCREASED PRODUCTION

One and three-quarter tons of high speed sawing machinery controlled by your finger tips speeds production by cutting down handling and loading time.

Control and operation of RACINE High Speed Saws is simple and easy with all controls conveniently located in front position . . .

1. **A Single Lever** shifts the sliding gear transmission for providing cutting speeds of 60, 90, and 130 strokes per minute.
2. **A Single Graduated Dial** controls cutting by setting feeds exactly for the full run of materials from thinnest walled tubing to heavy bars, billets and die blocks.
3. **A Single Lever** controls all operating phases, clutch, rapid traverse, rest, and height and depth of cut. Nothing to wear or get out of adjustment.

This is simple fool proof construction. It makes inexperienced operators produce more . . . faster . . . with greater accuracy. RACINE Heavy Duty saws are made in capacities of 10" x 10" to 14" x 20".

Write for catalog 80-B describing these saws in detail or for information on RACINE'S complete line of saws from 6" x 6" to 14" x 20" in production, general purpose, and automatic types. Get your production done faster — use RACINE.

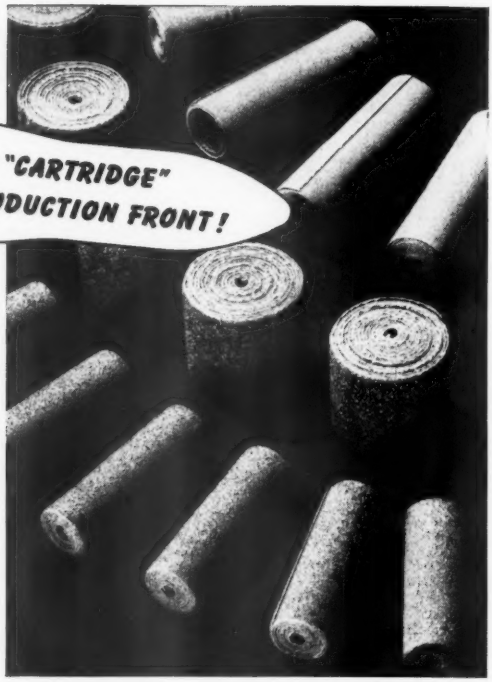
"Standard the World Over"

RACINE METAL CUTTING MACHINES

RACINE TOOL AND MACHINE COMPANY

1768 State Street **Racine, Wisconsin**

A NEW TYPE OF "CARTRIDGE" FOR THE PRODUCTION FRONT!



NEVER before has the metal working industry been called upon to grind, finish or polish such a bewildering variety of parts, fittings and finished products. And never before has there been such a demand for improved metal finishing techniques.

To supply this demand and enable users to keep pace with war production demands, The Carborundum Company has developed many new and novel coated abrasive devices — Weapons for Production, which make possible faster production at lower cost.

One of the most interesting of these is the cloth cartridge roll for finishing otherwise hard-to-get-at surfaces. It is simply a tightly wound glued strip of metal working cloth. The center bore formed by the winding is easily pressed onto a spindle of suitable diameter and length. It is then ready to use on a flexible shaft, air or electric tool.

Sizes range from ⅜" to 1" in diameter and 1" to 3" in length. Grit sizes range from 24 to 320.

These rolls have been found exceptionally effective in finishing, cleaning or polishing out-of-the-way surfaces that are hard to reach, yet must be finished.

The cartridge roll operates much like a mounted abrasive wheel but has the added advantage of being somewhat resilient. It is also economical and long-lived. As the abrasive surface wears down the cloth backing can be unwound and torn off to expose a fresh layer of abrasive.

If you care to see and feel and try one of these cartridge rolls we will be glad to send you one free of charge. Simply address your request to Dept. TD, The Carborundum Company, Niagara Falls, N. Y.

CARBORUNDUM
REG. U. S. PAT. OFF.
ABRASIVE PRODUCTS

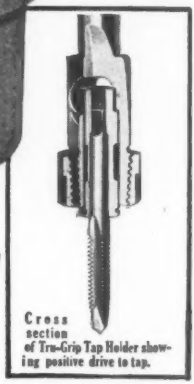
THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

Here's How To Get More Efficient Tapping at Lower Cost . . .

The exclusive advanced design of the new Procunier Tapping Heads assures you accurate tapping at high speeds with automatic protection for taps! Tap is driven by a double-cone, cork-faced friction clutch which automatically regulates tap driving power by pressure applied through the drill press spindle. Operators can quickly detect dull or loaded taps by the "feel", or pressure on the clutch, required to drive them thus avoiding needless tap breakage. With this sensitive Procunier smooth-operating friction clutch, bottom tapping is as simple as through tapping, since the clutch instantly slips should the tap strike bottom or stick due to tap loading.



Cross section of Tru-Grip Tap Holder showing positive drive to tap.

EXTERNAL THREADING

Standard Procunier Tapping Heads can be equipped for external threading. Produce accurate work and increase output.

Send for Bulletin

giving full details, description and prices on complete line of Procunier Precision Tapping Heads to meet all needs. The new Tru-Grip Tap Holder—and also the full line of Procunier Universal Tapping machines, hand or foot-operated.

Procunier Safety Chuck Co.
12-14 S. Clinton St., Chicago

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name .....

Address .....

PROCUNIER SAFETY CHUCK CO.
12-14 S. Clinton St., Chicago, Ill.

The Interchangeability of DANLY DIE SETS IS IMPORTANT TO YOU *In the* OCCASIONAL REPLACEMENT OF A PART

It Is Far More Important As a Continuous Guarantee of Accuracy in Die Making and Daily Production of Stampings

WRITE OR CALL YOUR DANLY BRANCH

DANLY MACHINE SPECIALTIES, INC.
2100 So. 52nd Ave., Chicago, Ill.

111 E. Wisconsin Ave., Milwaukee, Wis. 1549 Temple Avenue, Detroit, Michigan
47-28 37th Street, Long Island City, N. Y. 16 Commercial Street, Rochester, N. Y.
990 E. Monument Avenue, Dayton, Ohio 1550 East 33rd Street, Cleveland, Ohio
3913 North Broad Street, Philadelphia, Penna.
Ducommun Metals & Supply Company, Los Angeles, California; San Francisco, California

DANLY DIE SETS and DIE MAKERS' SUPPLIES

FAIRCHILD BUILDS ✕ ✕ ✕ BOMBERS

AIDED BY ▬ ▬ ▬ SIMMONS LATHES

SELECTOR DIAL CONTROL

THE BOLINGBROKE, like other great bombers making up the striking force of the United Nations, demands high precision manufacture of thousands of small parts.

At the Fairchild plant, a battery of 20 dependable Simmons Micro-Speed Turret Lathes, equipped with Selector Dial Control, is on the job . . . helping to mass-produce Bombers for Victory!

1¼" Bar Capacity. 14" Swing. Made in plain and back-geared types. Timken Tapered Roller Bearings. Spindle Brake. 1000 spindle speeds instantly available at a turn of the handwheel adjacent to Selector Dial on cabinet base.

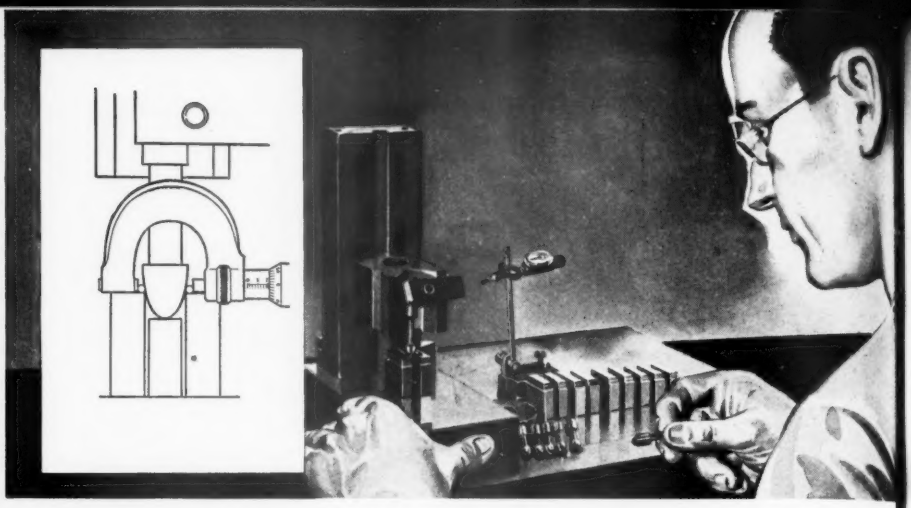
No. 2 TURRET LATHE
(1¼" Bar Capacity)

Write TODAY for Descriptive Bulletin.

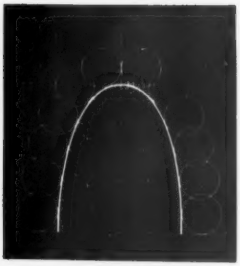
SIMMONS MACHINE TOOL CORP.
Main Office: 1760 NORTH BROADWAY, ALBANY, N. Y.
New York Office: 149 BROADWAY

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES



How to Measure Precision Bullet Gage Contours



In the illustration above, contours for Ogive Gages for 30 cal. cartridge cores are being checked to the extremely close limits of .00005″ with the aid of WEBBER GAGE BLOCKS.

Here's how it's done:—

The gage is held vertically with nose resting on a WEBBER Gage Block. Diameters are measured at designated intervals above nose point by resting rolls diametrically opposed on top of two more WEBBER Gage Blocks. Measurements are then taken across rolls with micrometer... thus checking dimensions as required. The line drawing above left illustrates this operation.

Here's just one example of how WEBBER Gage Blocks (guaranteed to .000004″) can facilitate and speed your precision measuring operations on mass production of war goods.

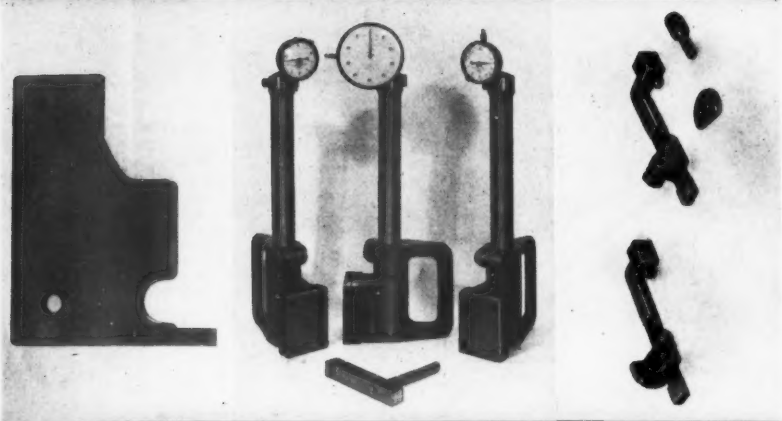
To meet demands of wartime, Webber's entire productive capacity is being devoted to the manufacture of GRADE A BLOCKS only.

Webber GAGE COMPANY

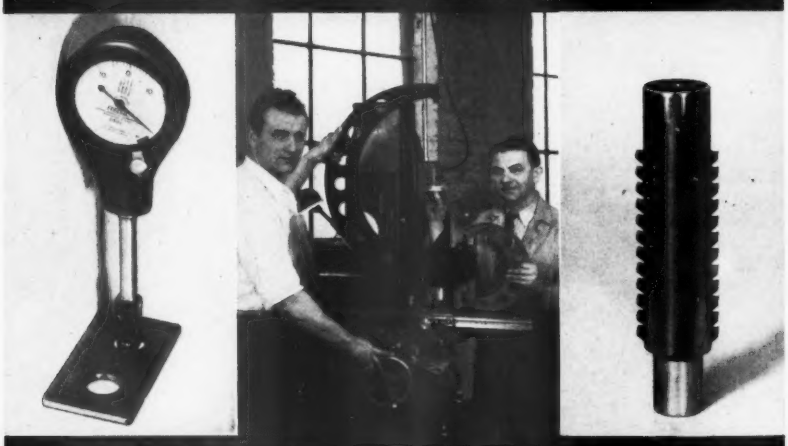
12903 TRISKETT RD., CLEVELAND, OHIO

Prompt delivery to firms furnishing necessary priority certificates. Prices for Set No. 81A—$350.00. Set No. 40A—$185.00.

NORTON No. 2
Cutter and Tool
GRINDER
THIS versatile machine provides for operation from front or either side with equal ease. Its massive wheel slide carries a standard driving motor which moves up and down or swings around with the column. The work table moves on balls between hardened ways. A single thumb screw engages a 50/1 reduction for fine, slow table movement. Attachments are available for all types of cutter grinding.
NORTON COMPANY
Worcester, Mass.
M-448
NORTON
GRINDING MACHINES



MEETING THE GROWING DEMAND



VICKERS BROACH & GAGE CO.

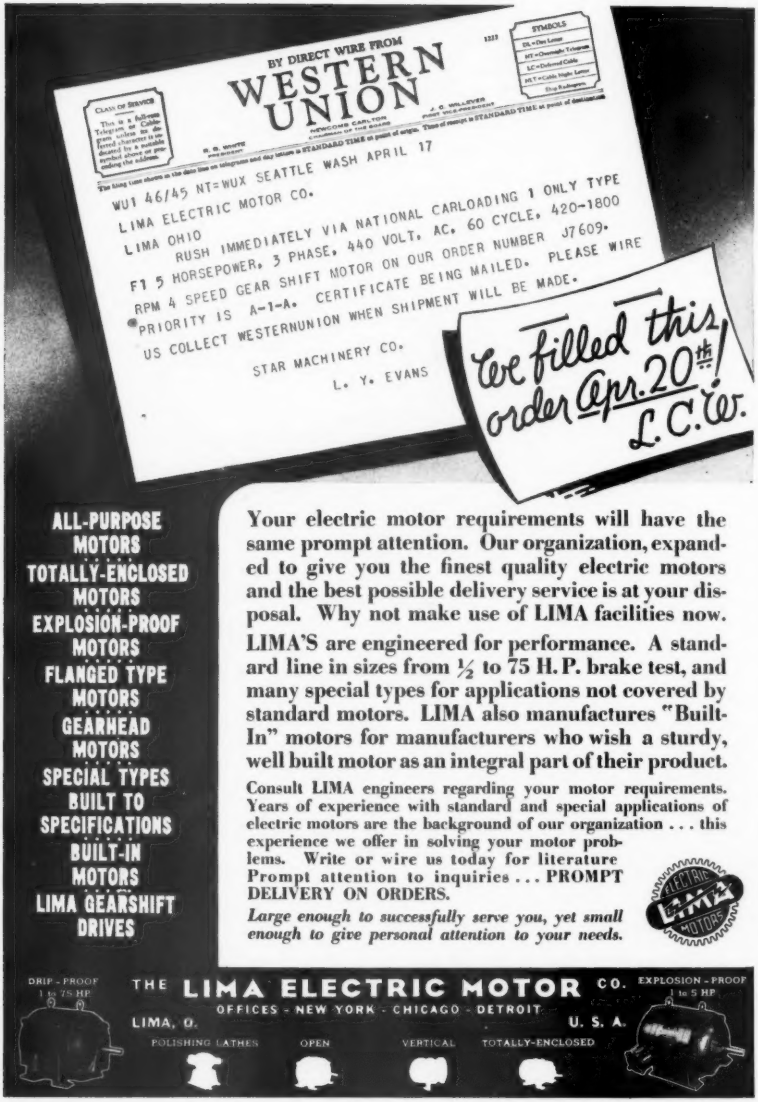
1009-15 FRANKLIN ST. DETROIT, MICH.

Tannewitz VARIABLE SPEED BAND SAWS

Instantly adjustable to the IDEAL Speed for cutting Metal of EACH and EVERY Type!

● In cutting off gates and risers from castings of various metals, practically any size, in cutting steel sheets up to ¼-inch thick, cast iron, plastics or any one of dozens of other cutting operations, a TANNEWITZ Variable Speed Metal Cutting Band Saw will do it quicker, better, and show a handsome return on the investment involved. There are five new models in addition to our regular High Speed Band Saws, including those which handle work as wide as 52 inches, and those with 48-inch clearance beneath the guide. Get a line on the TANNEWITZ metal cutting band saw that fits your particular needs. It will save time, step up production and repay its cost dozens of times. Write for full particulars NOW!

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

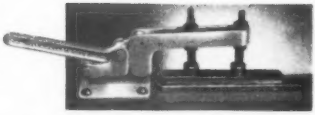

BY DIRECT WIRE FROM
WESTERN UNION
WU1 46/45 NT=WUX SEATTLE WASH APRIL 17
LIMA ELECTRIC MOTOR CO.
LIMA OHIO
RUSH IMMEDIATELY VIA NATIONAL CARLOADING 1 ONLY TYPE
F1 5 HORSEPOWER, 3 PHASE, 440 VOLT, AC, 60 CYCLE, 420-1800
RPM 4 SPEED GEAR SHIFT MOTOR ON OUR ORDER NUMBER J7609.
PRIORITY IS A-1-A. CERTIFICATE BEING MAILED. PLEASE WIRE
US COLLECT WESTERNUNION WHEN SHIPMENT WILL BE MADE.
STAR MACHINERY CO.
L. Y. EVANS
We filled this order Apr. 20th!
L. C. W.
ALL-PURPOSE MOTORS
TOTALLY-ENCLOSED MOTORS
EXPLOSION-PROOF MOTORS
FLANGED TYPE MOTORS
GEARHEAD MOTORS
SPECIAL TYPES BUILT TO SPECIFICATIONS
BUILT-IN MOTORS
LIMA GEARSHIFT DRIVES
Your electric motor requirements will have the same prompt attention. Our organization, expanded to give you the finest quality electric motors and the best possible delivery service is at your disposal. Why not make use of LIMA facilities now.
LIMA'S are engineered for performance. A standard line in sizes from ½ to 75 H. P. brake test, and many special types for applications not covered by standard motors. LIMA also manufactures "Built-In" motors for manufacturers who wish a sturdy, well built motor as an integral part of their product.
Consult LIMA engineers regarding your motor requirements. Years of experience with standard and special applications of electric motors are the background of our organization . . . this experience we offer in solving your motor problems. Write or wire us today for literature Prompt attention to inquiries . . . PROMPT DELIVERY ON ORDERS.
Large enough to successfully serve you, yet small enough to give personal attention to your needs.
ELECTRIC LIMA MOTORS
DRIP-PROOF 1 to 75 HP
THE LIMA ELECTRIC MOTOR CO.
OFFICES - NEW YORK - CHICAGO - DETROIT
LIMA, O. U. S. A.
EXPLOSION-PROOF 1 to 5 HP
POLISHING LATHES
OPEN
VERTICAL
TOTALLY-ENCLOSED

Another forward step in clamping operations! In fact, four forward steps—each contributing a definite speed factor in production.

4 More KNU-VISE FIXTURES To Speed Up Your Clamping Operations

★ **MIDGET CLAMP.** Improved Model. Toggle bar strengthened, with bolt retainer now integral with bar. Spindles uniformly centered. Exceptionally practical in holding small parts where heavy clamping pressure is required. Spindle has rubber cap.

★ **PARALLEL CLAMPING PLIERS.** The extended parallel jaws aid clamping efficiency by exerting pressure uniformly over greater area. Particularly effective in gluing plywood. Two-spindle adjustment. Already extensively used in aviation industry on plywood gliders and training planes.



★ **U-SHAPED TOGGLE BAR.** Permits simultaneous clamping of many parts regardless of their thickness. Two spindles with rubber caps, adjustable horizontally and vertically, are pre-set at required locations and remain in these fixed positions during continuous operations. Handle in horizontal position when closed.

★ **L-CLAMP.** Designed for clamping small parts, either in assembly or production jobs. For use in limited spaces or where large throat capacity is required, such as in the clamping of L-sections in aircraft construction. Handles at right angles to clamping position.

Perhaps YOUR plant can make advantageous use of one of these or other Knu-Vise features. Ask for a demonstration in your plant.

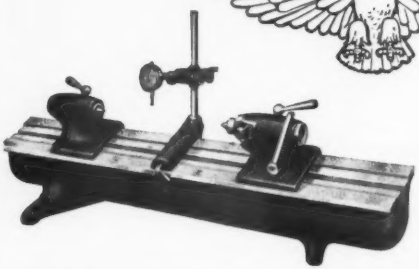
KNU-VISE INCORPORATED

IMMEDIATE DELIVERY

1332 Plum Street • DETROIT, MICH.

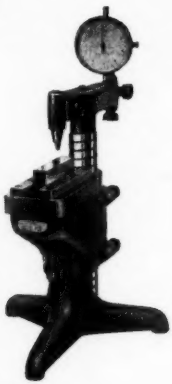
4328 San Fernando, Glendale, California

AVAILABLE FOR WAR PLANTS



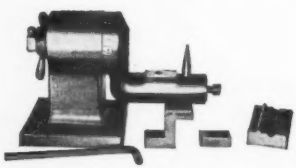
AMERICAN BENCH CENTER

Improved design. Three sizes: 4"x10"; 6"x24" and 8"x36". Inclined bed to better facilitate removal of work. Box type construction, precision scraped. Ruggedly built for either inspection or production work.



AMERICAN THREAD CHECKER

Recommended and used by leading manufacturers of thread grinding equipment for accurately checking threads on pitch line to one ten-thousandth. Capacity up to 5 in. diameters.



UNIVERSAL RADIUS DRESSER

Dresses surface grinding wheels to either convex or concave radii to quarter-tenth accuracy. Will improve the radii on your gauges, grinding formers, form tools, punches and dies.

NEW FACILITIES

New facilities and expansion of output make reasonable deliveries possible now to essential war plants on these vital inspection devices.

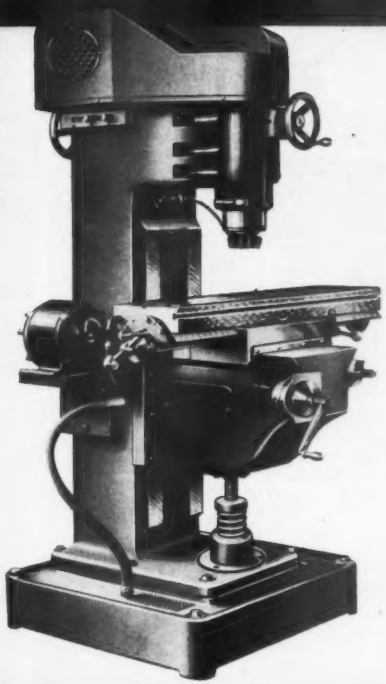
Write or wire for details

THE AMERICAN GAUGE CO.

128 Bayard Street ∴ Dayton, Ohio

Designers and Builders of Tools, Dies, Gauges and Checking Devices since 1919

ANOTHER BOOST FOR VICTORY!



JACKSON No. 2½

Precision Built-Heavy Duty

VERTICAL MILLER

Drive: 1½ H. P. Motor; V-Belt, Worm and Worm Gear.

12 Speeds; 9"x 39" Table.

Travels: 14" vertical, 10" cross, 23" longitudinal; 4" vertical spindle.

Weight: 2400 pounds.

Long. Power Feed and Automatic Coolant.

Shipments now being scheduled for next 90 days deliveries under W. P. B. Order E-1-B. Phone or Write.

JACKSON

MACHINE & TOOL COMPANY

• SALES DIVISION •

JACKSON, MICHIGAN

U. S. A.

ACTUAL REPORTS SHOW

Big Increase in Production of TOOLS • DIES • PRECISION PARTS

with DESPATCH FURNACES

This is no time to compromise with production. Speedy, accurate heat treatment is needed to achieve the output of tools and dies scheduled for this year.

Actual reports show that greater production of tools, dies and precision parts is attained after the installation of Despatch furnaces.

Investigate the advantages of Despatch heat treating furnaces for your plant. 64 standard models, gas or electric, pot type or batch type furnaces available for prompt delivery. Also special models to suit any material handling necessary.

Despatch Batch Type Furnace, gas heated, processing steel springs in a midwestern metal plant

Battery of Despatch Pot Type Furnaces, electrically heated, processing bearing parts at a large eastern plant

"Torrid"
The Heat Wizard
Invites you to visit the Despatch Booth No. A-415, National Metal Congress, Cleveland, October 12th to 16th.

DESPATCH
OVEN COMPANY MINNEAPOLIS, MINNESOTA

VICTORY TOOL SHANKS

Spell Victory for You over Tool Steel Scarcity

Forget about scarcities of low carbon steel for tool shanks. Turn to Cooper-Bessemer's Victory Tool Shanks, cast from tough Meehanite alloy iron.

These Meehanite shanks have double the vibration damping capacity of steel. Their heat dissipation is far superior to that of steel. They require a minimum of machining before use. The coefficient of expansion of Meehanite is closer to carbide than is steel. And best of all, *Victory Tool Shanks are available NOW.*

If you tip your own cutting tools, you'll want to try Victory Tool Shanks. Quotations on patterns and castings for special shapes furnished promptly. Shipments of small quantities of standard sizes can be made within a few hours after receipt of order.

THE COOPER-BESSEMER CORPORATION
Sugar St., Mount Vernon, Ohio

Free Bulletin . . .

Get your copy of this illustrated bulletin which shows sizes of Victory Tool Shanks carried in stock and gives prices. Then pick out a size you can use and ask for a few sample shanks to try out. Request Bulletin No. 52T-1.

Cooper-Bessemer

HOW TO GET THE MOST OUT OF YOUR LATHES

No. 2 *in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient production.*

Keep Them Well Oiled

For lack of oil the bearing was lost;
For lack of a bearing the tank was lost;
For lack of a tank the battle was lost;
All for the lack of a film of oil.

All bearings should be oiled at regular intervals

Paraphrasing the rhyme about the horseshoe nail, an army officer is said to have used this verse to emphasize the importance of lubrication.

The proper lubrication of lathes and other machine tools will help our war effort by preventing production interruptions, and saving critical materials and labor by reducing the demand for replacement bearings, parts, and machines.

South Bend Lathes, like other fine machine tools, have large oil reservoirs, felt wicks, and oil retainers to guard against lack of oil due to temporary neglect or oversight. But for best results the lathes should be oiled at regular intervals. Even a camel must have an occasional drink.

Make Oiling a Habit

All oil holes and oil cups should be filled at least once a day — oftener when top speeds and feeds are employed. Best practice is to fill each oil hole in a regular sequence so that oiling becomes a habit and no oil holes are overlooked. When the lathe is in service on two or more shifts, oiling the lathe should be the first daily task of each operator.

Use Correct Grade of Oil

When the correct grade of oil is used in a well designed bearing there is little or no metal-to-metal contact. However, when the wrong grade of oil is used, or if the oiling is neglected, the oil film will break down and the bearing surface may be damaged in a short time.

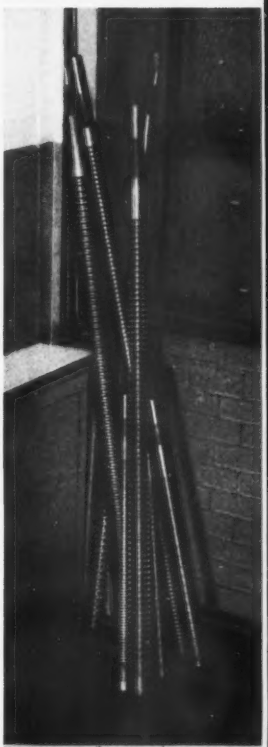
Write for Bulletin No. H2

Bulletin No. H2 giving more complete information on oiling the lathe will be supplied on request. Oiling charts for South Bend Lathes (advise serial number), and reprints of this and other advertisements in this series can also be supplied.

SOUTH BEND LATHE WORKS

Dept. 802 **South Bend, Ind., U. S. A.** **Lathe Builders for 35 Years**

THE QUICKEST WAY TO SPOIL GOOD BROACHES . . .



. . . Lean them against each other in a corner

How to get more production with your Broaches . . . . . .

1. BY PROPER HANDLING

IT TAKES time to recondition a damaged broach. Careless handling of your broaches may tie up production. Here are a few good rules to follow to protect these vital war tools:

(a) Always provide individual storage racks for broaches. These should either be of a material that will protect the teeth from damage or else should be lined with such material. If cutting edges of broaches are allowed to strike against each other they may be chipped or nicked.

(b) Never drop a broach on any hardened surface. Broaches are usually made of high speed steel and may even be tipped with tungsten carbide. You may chip, nick, or even break the teeth.

(c) When broaches are to be stored for any period of time they should be treated to protect them against corrosion.

(d) Equipment for moving broaches from one department to another should have separate compartments to prevent nicking of broach teeth.

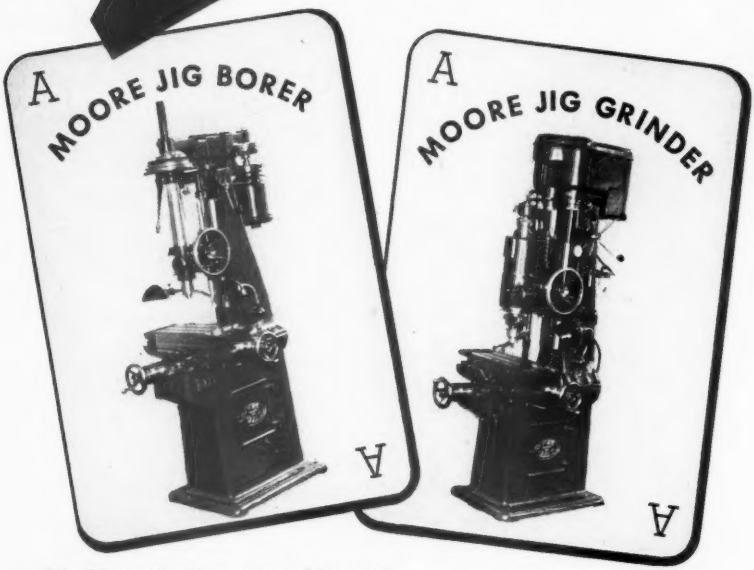
COLONIAL broaches are designed to enable you to machine your parts more accurately, quicker, and at a lower tool cost per piece than with virtually any other method of stock removal. Give them a chance to do an all-out job for you. Handle them carefully.

colonial BROACH COMPANY

Broaching Machines — *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

2 TOOLROOM ACES...



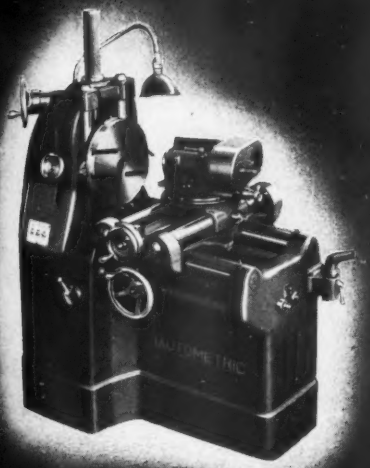
The Moore Jig Borer, designed for rapid drilling, boring, reaming and checking operations, answers today's need for versatility and high precision in war production. Layout and jig boring problems will be efficiently solved with this simple-to-operate machine which is also used for jig-less small-lot production in many ordnance plants.

This new-type jig grinder corrects and finishes jig-bored holes in all kinds of tool work after hardening. Hole locations can be corrected within .0001" and may be ground straight, or tapered by hand or power feed. Speeds up checking and measuring.

And here's a toolroom tip. Used in conjunction with each other, the Moore Jig Borer and Jig Grinder, like "aces back-to-back," make a perfect pair...a sure bet to turn out high-precision work at high speed and low cost.
● Write today for descriptive bulletins.

Manufactured by **MOORE SPECIAL TOOL CO., INC., Bridgeport, Conn.**

Exclusive Distributors: **MARBURG BROTHERS·INC**
88-92 WEST STREET · NEW YORK, N. Y.



AUTOMETRIC
JIG BORING MACHINE
MODEL "A"

ANNOUNCEMENT . . .

THE complete line of Autometric Jig Boring Machines, formerly built by the Autometric Machine Tool Company of Berkeley, California—is now being produced by the Kearney & Trecker Products Corporation of Milwaukee, Wis.

There are three machines in the line—two horizontal and one vertical. Each is designed to handle a wide range of precision work. Speed, flexibility and extreme accuracy are hi-spot features . . . The Autometrics will have the same high-quality construction as that found in other well-known equipment designed and built by the Kearney & Trecker Products Corporation.

KEARNEY & TRECKER PRODUCTS CORPORATION
A Subsidiary of the Kearney & Trecker Corporation
MILWAUKEE, WISCONSIN

AUTOMETRIC
JIG BORING MACHINE
MODEL "B"

(Continued from Page 58)

plunger travels forward, finishing its stroke a small distance beyond the parting line surface of the cavity insert plate (3). But, he should provide a slight taper, making the opening larger at the parting line than at one-half inch from the parting line.

Construction Features

The "hot" or cover half of the die fastens to the machine stationary die plate (Detail 31, Fig. 7) and consists of the following parts: Cover Binder Plate (1); Cavity Inserts (2); Cavity Insert Plate (3); Guide Pins (4); Plunger Metal Bushing (17); and Gate Cover Block (18).

The ejector half of this die consists of the Core Insert Plate (6), Core Inserts (7), Core or Ejector Binder Plate (8), Ejector Box Legs (9 and 21), Ejector Pins (10), Support Post (11), Ejector Pin Retainer Plate (12), Ejector Plate (13), Guide Pin Bushings (5), Gate Block (20), and Surface or Push Back Pins (23).

The Cover Binder Plate (1), the Cavity Insert Plate (3), and the Core Insert Plate (6), after being individually "cleaned", are first bored for guide pins and guide pin bushings (4 and 5). Next, cavity and core insert plates (3 and 6) are machined and fitted with the gate cover and gate blocks (18 and 20). The cavity and core plates are then machined together for cavity and core inserts (2 and 7). The plates are also counterbored for the shoulders on above inserts.

After the round cavities (2) are machined, hardened and fitted into the holes provided for them in the cavity insert plate (3), the cover binder plate (1) with clamping grooves (14) already machined is drilled and counterbored for socket head screws. These holes are "spotted", drilled and tapped in the cavity insert plate, then fastened together. The hole for the hardened plunger metal bushing (17) is now bored for a press fit with the bushing, and the bushing is placed. The cover

(Cont'd on Page 135)

DOUGLAS

PLAIN MILLER

FOR SMALL PARTS PRODUCTION

WIDE RANGE OF SPINDLE SPEEDS from 75 to 1200 R.P.M.

TABLE SIZE 32" x 8"

QUICK DELIVERY BY LARGE SCALE PRODUCTION

DOUGLAS MACHINERY CO. INC.

150 BROADWAY NEW YORK, N. Y.

OPA Price Reg. 136, as amended, is explained for the Tool & Die Industry in this issue. See page 47.

"Producers of Die Castings will be

BUSY-

—when users learn the Quality of

SUPER-PRESSURE DIE CASTINGS"

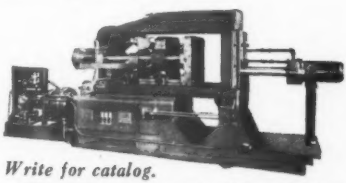
Many users of die castings do not know that they can now obtain *CASTINGS CAPABLE OF PASSING INDIVIDUAL X-RAY INSPECTION.*

Note the dense, compact structure (in microphoto at left, 100 diameters) of this aluminum alloy super-pressure die casting.

A far denser structure is obtained when a die casting is made with injection pressure of 22,000 lb. psi.
Porosity is no longer a hazard; on X-Ray inspection, rejects run consistently below 1%.
Strength and Hardness are substantially increased.
Closer Tolerances may be specified, as super-pressure gives better uniformity of Dimension, as well as more uniform Quality.

Show this to users of die castings, to benefit all producers who have kept abreast of modern developments.

(If you want to know just what improvement super-pressures will make in any die cast part, send us a sketch or a sample and we will advise; no charge or obligation).



Write for catalog.

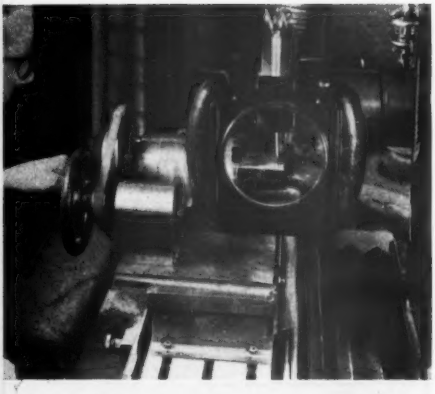
New Lester-Phoenix Die Casting Machine with non-elastic beam type cast steel frame. 360% greater frame area for holding the dies closed; closing pressures, 400 to 600 tons.

◆

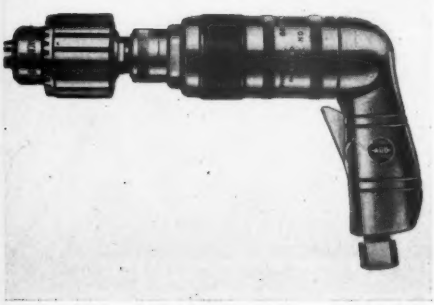
LESTER-PHOENIX, Inc.
2721 Church Ave. Cleveland, Ohio

LESTER-PHOENIX
DIE CASTING MACHINES
HIGHER PRESSURES *make* STRONGER CASTINGS

PROGRESS ON PARADE



THE Boyer-Campbell Co., 6542 Antoine St., Detroit, Mich., recently introduced a new model Super Sight for precision machining. The magnifying lens is 5" in diameter and can be equipped with a safety lens when required. Universal brackets facilitate setting in the exact location desired.



THE addition of new ⅜" capacity air drills, straight and right angle, to their line of rotary pneumatic tools is announced by The Aro Equipment Corp., Dept. T, Bryan, O.

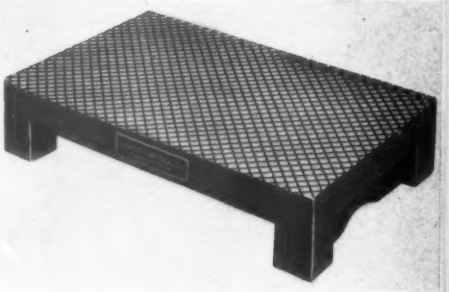
These drills are suitable for a wide range of jobs for aircraft builders, shipyards and other war plants. Other pneumatic tools for drilling, screwdriving, nutsetting, grinding, filing, polishing, sanding and paint mixing are also available from this manufacturer.

SPEEDING both production and deliveries, a line of production-standardized special taps for tapping both ends of 40 and 20 mm shell is being produced by Detroit Tap and Tool Co., 8436 Butler St., Detroit, Mich.

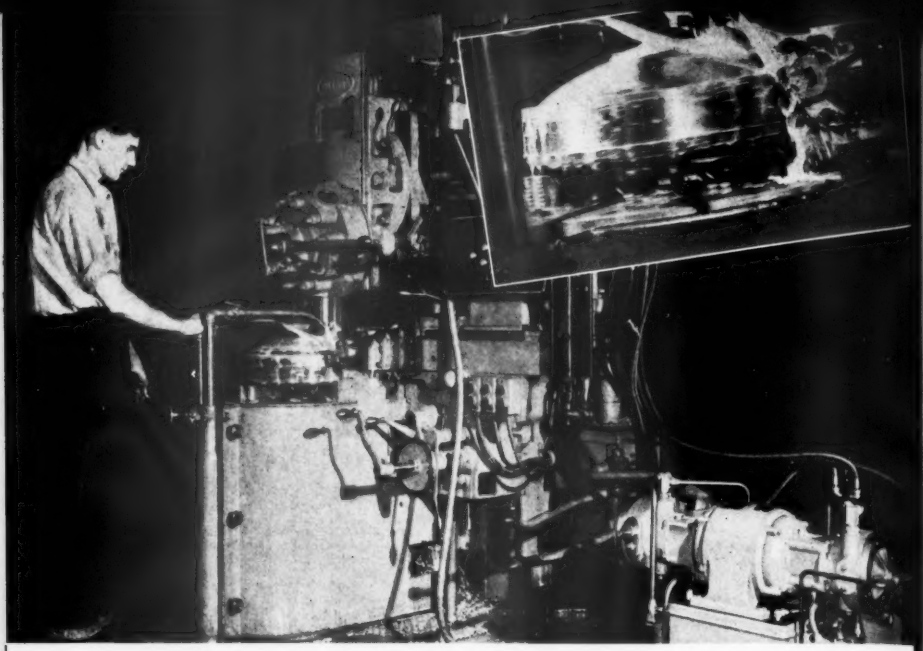
A year ago virtually every shell manufacturer had his own special tap specifications and designs for the same operation. Since the "compromise" designs were developed by the Detroit organization, over half of the shell producers whom it supplies have already adopted the new taps.

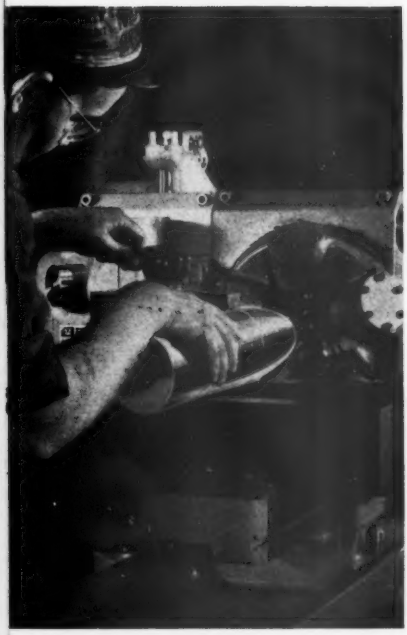
AN improved lapping plate designed by practical tool makers has been announced by The American Gauge Co., 128 Bayard St., Dayton, O. It is a convenient size to place on the tool maker's bench.

This lapping plate is highly recommended for all types of gages and surfaces requiring close tolerances.



THE Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn., is now manufacturing a self-centering shaft vise to hold spindles or shafts for such operations as keywaying, slotting or splining. The vise is made for vertical or horizontal mounting on a machine table—both bases being accurately machined at right angles. The vise will handle shafts or spindles ⅜" to 3⅛" diameter and any necessary lengths. This is an entirely new departure in vise construction as it insures accurate radial cuts.





FORGED steel parts for torpedoes are now being form-turned automatically on a standard Bullard vertical lathe without special rebuilding of the machine.

The use of a Duplimatic to turn the horizontal and vertical feed screw of the Bullard lathe has resulted in stepped-up production on the roughing cut and increased accuracy on the finish—virtually eliminating rejections. This precision machine tool control is manufactured by Detroit Universal Duplicator Co., 257 St. Aubin Ave., Detroit, Mich.

A MULTIPLE spindle head for simultaneously milling a number of staking notches in shell noses has been placed on the market by Kent-Owens Machine Co., Dept. T, Toledo, O.

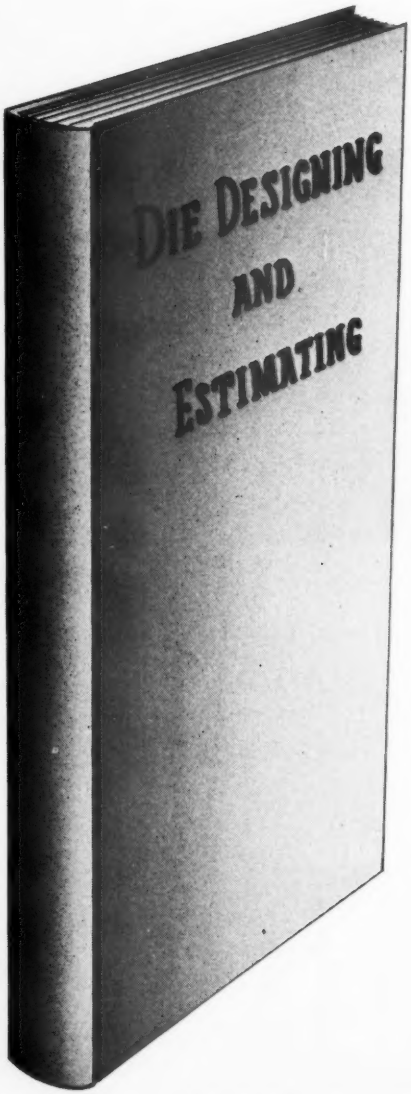
The illustration shows a 5-spindle head which mills all fine staking notches in a typical shell at the same time. Actual machining time and handling time are reduced to a fraction of that formerly required.

AIRCRAFT Tools, Inc., 758 E. Gage St., Los Angeles, Calif., have developed a hole-cutting saw made of solid, high speed tool steel for fast, accurate cutting of sheet stock. Both inside and outside diameters are ground with ½° clearance to insure free cutting through thin skins and corrugations.

THE L-Clamp is an entirely new design in clamps. Its development by Knu-Vise, Inc., 1332 Plum St., Detroit, Mich., resulted from a recognized need in aircraft construction for something to hold L-section more satisfactorily. It is very practical in limited spaces or where large throat capacity is necessary. The clamp can be placed in any position and not project out into space.

STIMULATED by industry's wartime production requirements for positive balancing equipment, Gisholt Machine Co., 1196 E. Washington Ave., Madison, Wis., have broadened the overall range of the Dynetric Balancing Machine line to extremes of 1 ounce and 50 tons. In the rear of the illustration is shown the Gisholt Floor Type Dynetric Balancer as used for balancing a marine reduction gear (50 tons, 16′ 8″ dia., 7′ 14″ face width).

The left front of the illustration shows the Type S Dynetric which balances parts weighing as little as one ounce.



DIE DESIGNING AND ESTIMATING

This book, largely written by specialists, is of timely interest today. It skillfully covers the subject of Die Designing and Estimating concisely, systematically and with authority. It is indeed the perfect book for the tool and die shop man!

Over 125 drawings, charts and photographs, carefully selected to illustrate modern die designing practice, are included. The estimating data is complete enough to follow from rough sketch to a final, sound estimate.

Fifteen new Estimating Tables, Separate Index of Time Value Tables, 150 Practical Points on Die Designing and Building—all included in the new DIE DESIGNING AND ESTIMATING. Price: $3 plus nominal postage charge.

AMERICAN INDUSTRIAL PUBLISHERS

338 Fairmount-Cedar Bldg. - Cleveland, Ohio

(Continued from Page 128)

or "hot" side of the die is now completed.

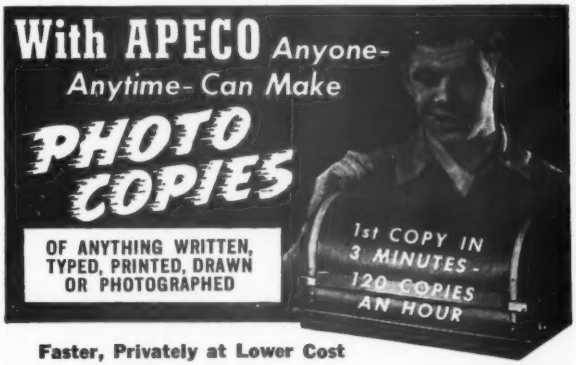
The round core inserts (7) are machined with four reamed or lapped holes in each for ejector pins (10). They are then hardened and fitted into the holes provided for them in the core binder plate (8). The core binder plate (8) will then be fastened to the core insert plate (6) in the same manner as was done in the cover and cavity insert plates. The holes for the ejector pins (10) can be located from the core inserts (7), and then clearance drilled in the ejector or core binder plate (8).

The ejector box consists of three pieces: Two ejector box legs with a clamping groove in each (9 and 21), and the support box (11). The three parts are fastened to the ejector binder plate (8).

The ejector pin retainer plate (12) is drilled and counterbored for ejector and surface pins (10 and 23), and fastened to the ejector plate (13). A hole is bored through both plates slightly larger than the support post (11) to insure that no friction will be created between the post and the plates.

A water hole (25) is drilled and tapped at both ends to provide for water connections in the cover binder plate (Figs. 1 and 3); this line provides the cooling necessary in the cover die half. Water lines are also drilled on an angle (Detail 24, Fig. 2) so that they meet in the center of the dies in the core insert plate (6). It would be impractical to put a water line in the ejector binder plate, because the ejector pins would interfere; and if these holes were placed any farther away from the cavity, the effectiveness of cooling would be minimized.

The Plasticator Section features an article on "Machinery of Phenolic Laminate" by S. A. Rulon. Many shop men working with plastics for the first time will find this article extremely valuable. **Turn to page 94.**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WT. 10 LBS.

Cutter Tool Has Four Interlocking Tool Bits

THE State Boring and Reaming Bar is a multiple cutter tool with four interlocking tool bits. These tool bits are fully adjustable within the range of each bar size, with a single fine thread adjustment screw. The four cutters, all firmly anchored, extend beyond the boring head and are capable of quick and accurate adjustment, yet with a great percentage of the bit shank remaining within the tool body even when extended to its greatest diameter.

The operating principle of this bar is that the four cutters bore on the front cutting edge and ream on the sides. Since there are four tools doing the work it can readily be understood that this tool will operate with maximum efficiency at far greater speeds than would normally be applied to single or two cutter boring tools.

Many production applications have been found where a special wear strip attachment has added to the effectiveness of the boring or reaming bar. These wear strips keyed into the bar act as a pilot for the bar through a jig or fixture. This method of piloting is exceptionally well suited where the bore is only a part circle and the bar cannot support itself through the hole.

Additional information on Collared Bars, Piloted Bars and Single Cutter Bars can be obtained from the State Mfg. and Construction Co., Dept. T-10, Franklin, O.

WELDON ROBERTS

Brightboy

A NEW HIGH FOR FINISHING SPEED

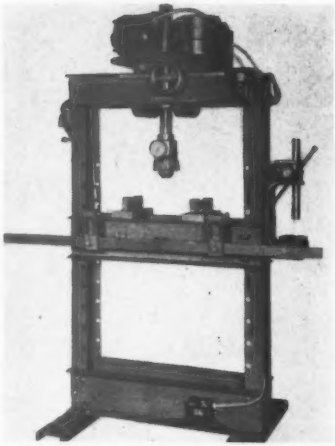
"The Soft Rubber Binder Cushions the Abrasive"

Finishing speed-ups are being achieved in many war industries by BRIGHTBOY. Because Brightboy's abrasive is **rubber cushioned**, it produces a unique abrasive action, bridging the gap between a grind and a buff. Works on all metals. Made in wheels and also in various shapes for manual and drill press work.

Brightboy field men are at your service. Write for catalogs and prices if your dealer cannot supply you.

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark, N. J. U.S.A.

Pressurematic Press for Small Dies



THE recent introduction of an electric Pressurematic Press suitable for making small dies should be of interest to many bullet die makers.

Lempco Pressurematic presses are able to handle this die work because of an automatic pressure control. The Pressurematic was especially designed for jobs requiring pressure control, which consists of a pressure gage, electrically connected with a series of special relays. This gage may be set for any desired pressure. When the pressure reaches that point, the controls stop the ram instantaneously or may be set to reverse the mechanism and back the ram off the work. It can be set to rise any distance and then automatically return down again.

Since the automatic control prevents excessive pressure, spoilage is held to a minimum and even inexperienced operators can run the Pressurematic with fool-proof precision. The Pressurematic is fast, too, attaining a pressure of 60 tons in four seconds.

When used for making bullet dies, the control gage is pre-set. The Pressurematic then forces the nosing piece into the water hardening die steel to the precise depth required to form a smooth, clean cavity. The downstroke and the automatic uppower are both constant, steady and precise. Dies for .30, .45 and .50 calibre bullets as well as many other extrusion jobs are being successfully done by this method.

Write Lempco Products, Inc., Dept. TD, Bedford, O., for detailed literature.

Every man who
SEES BETTER, WORKS BETTER

MAGNI-FOCUSER
The New Binocular Eye-Loop

PROVIDES A SURE, SAFE WAY TO SPEED PRODUCTION

PRECISION workers increase their efficiency—with fewer accidents—when they use Magni-Focuser, the new Binocular Eye-Loop.

Its dual-mounted lenses magnify an object approximately three times its actual size to needle-point sharpness. This *binocular* design gives *third dimension* vision—true perception of depth—which is impossible with a one-lens magnifier.

Scientifically-designed prismatic lenses relieve eye-strain, and the shade shuts out glare and protects the eyes. Can be worn over regular eye-glasses. Feather-weight construction—made entirely of non-breakable, non-inflammable plastic.

Give *your* workers better vision with Magni-Focuser, and let them give you increased production. Now in use in hundreds of war plants and Government Departments. Order one or more now from your jobber or mill-supply house. If they are not yet supplied with Magni-Focusers, write for name of nearest distributor. Price, $8.50, satisfaction guaranteed.

EDROY PRODUCTS CO., DEPT. 12, 480 LEXINGTON AVENUE, NEW YORK

Grinder Has Auxiliary Drive

THE new Vernon universal tool and cutter grinder, an addition to the well-established line of Vernon milling machines, jig borers, and shapers, possesses several novel contruction features which provide an exceptionally smooth and sensitive action.

The spindle head is powered by a ½ hp, 60 cycle, 3 phase, ball bearing motor of 3450 rpm. Of importance is the internal auxiliary drive, which is substituted for the external spindle when doing internal grinding. Unnecessary wear on the external spindle assembly is thus eliminated.

Grinding speeds are varied by changing the motor pulleys only for external spindle work and by changing intermediate arbor pulleys only for internal grinding. This method of speed control eliminates possible brinelling of the precision bearings by thoughtless tapping of the pulleys in place on the spindles.

The column housing has extremely long ways, one of which is a 1½" Vee and the other a 2" wide flat. Wide spacing of the ways prevents overhang of any part of the column housing. Ways are protected against abrasives and coolant by guards. Transverse movement of the column is supplied through the hand wheel on the left side of the bed. An eccentric quill provides a backlash take-up between gears operating the cross feed mechanism.

Machinery Mfg. Co., 1915 E. 51st St., Vernon P.O., Los Angeles, California, will supply additional data.

2 Weeks Delivery

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FOR MORE THAN 40 YEARS

CARRYING AN A1-J PRIORITY RATING OR BETTER

Johnson No. 120 high speed steel heat-treating furnace, illustrated here, produces 2300° F. in just 30 minutes, and is ruggedly constructed to stand up under constant firing. Use it for hardening punches, dies, and tools. Firebox 13½"x7¾" x5", lined with insulating refractory. $149.50 F. O. B. Factory.

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New Johnson Catalog. Use Coupon

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560 E Ave. N.W., Cedar Rapids, Iowa

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SALES OFFICES:
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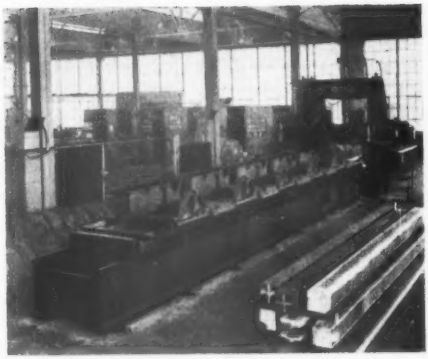
C. B. Babcock Co.
475 11th St.
San Francisco

Double Housing Planer Has New Feed



THE Liberty Double Housing Planer, it is said, is ideally suited for a large amount of production lying within a well defined range. Rigidly constructed, this planer will handle precision work with maximum cutting feeds and speeds.

Motor clamping and dual push button control enables operation from either side. Clamps for double housing planers operate through equalizer plate, insuring equal clamping pressure on each housing.

The drive is through a triple reduction .40-.50 carbon all steel gear train with herringbone high speed drive and double balanced intermediate drive. All gears run in a bath of oil with pressure lubrication to bearings.

The bed extends to the floor, affording a solid foundation for the machine. The top is closed between the vees, except through the gearing section which is reinforced by heavy tie ribs.

The feed is a decided improvement over old arrangements. A handle, conveniently located, determines whether the feed is to take place on the cut or the return stroke.

All Liberty Planers are tooled and jigged so that they are composed of parts as nearly interchangeable as is possible in machines of this type.

Catalog 152-TD furnishes complete information. Write Liberty Planers, Inc., Hamilton, O.

Eliminates Hand Lapping

Case History No. 6

Lapping of Intricate H.S.S. compression dies, with a Universal Slotmaster, requires a man's time only while setting up the job. . . . The operation is started by lowering the lapping arbor to the mouth of the die opening and then setting the down-stroke of the slotter so that it will completely compress the spring, which is mounted between a shoulder on the shank of the lapping arbor and the tool holder. The spring then gradually relaxes and the lapping arbor works its way into the opening, as a result of spring pressure and the stroking of the slotter. When the spring is completely relaxed — the down-stroke of the slotter is again set up to completely compress the spring and the operation is repeated until the full length of the opening in the die has been lapped.

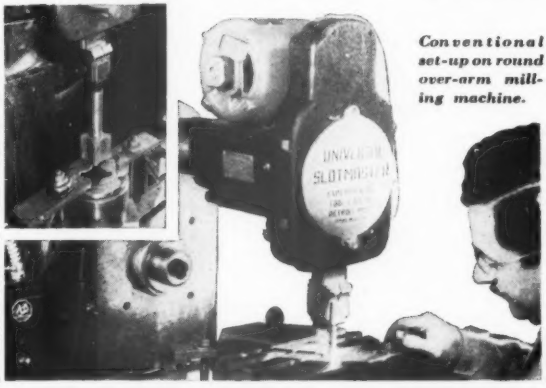
Thumbnail illustrates set-up.

SLOTMASTER can be used on milling machines and provides double duty facilities at a minimum cost. It requires but little time to change-over from one head to the other . . . The stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s. p. m. . . . The tool holder, of the clapper box type, can be turned in any position . . . All of the working parts are of tool steel heat treated and ground to close tolerances . . . SLOTMASTER comes complete with pulleys, motor, belt and mounting adaptable to round over-arm or flat-on-round over-arm milling machines.

Send for 4-page catalog and give the specifications of the milling machines that you wish to equip. Immediate deliveries on high priorities. (B-511 at Metal Congress)

EXPERIMENTAL TOOL & DIE CO.

12609 GREINER DETROIT, MICH.



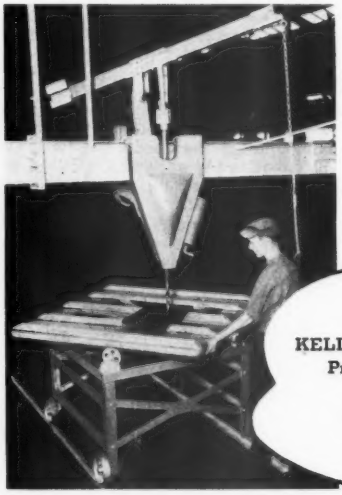
Conventional set-up on round over-arm milling machine.

OPA Reg. 136

(Continued from Page 48)

"Machinery services" may conceivably enter into the work of a tool and die builder. Such "services" refer to work performed on a part or product owned by another, and include not only machining and repairing, but also heat treating, welding, polishing, and plating. The Regulation provides that charges for machinery services shall be calculated on the basis of labor rates, machine hour rates, and overhead rates no higher than those in effect (or which would have been in effect for the same class of labor) on March 31, 1942, in the same locality.

It may be re-emphasized that Maximum Price Regulation No. 136, As Amended, has been drawn up in such a way as to recognize the impracticability of "freezing" actual dollar prices charged for special tools, dies, jigs, fixtures, etc. The essence of the price "freeze" as it applies to these items is that a manufacturer or builder must calculate the prices to be quoted or charged on the basis of labor rates, material prices, and the price-determining methods in use by him on the base date, that is, March 31, 1942. This procedure enables a builder to determine at once the maximum price of any of these commodities without reference to established list prices and without prior approval in each case by the Office of Price Administration. This has a further advantage for the builder in that no attempt is made to "freeze" amounts of time and material, but instead prices of the elements entering into the price-determining method as of the base date, March 31, 1942 are "frozen".



Speed Up Drilling with

KELLY-SPRINGFIELD
Production Drill
and
Drill Table

Extends cutting tool life four to five times, in drilling holes from ⅛″ to 2″ diameter . . . through armor plate or castings. A highly flexible production machine, the Kelly-Springfield I-Beam Production Drill brings the work to the drill by means of a rotating table and 9′ track. Fingertip control, with 4 speeds, both forward and reverse, for tapping.

FOR IMMEDIATE DELIVERY

THE O. S. KELLY CO.

Department JK **Springfield, O.**

TO increase the output of shells, tanks, guns and other ordnance material, many arsenals and ordnance plants are using CMD helical groove centers and CMD center point lubricants on lathes, milling machines, grinders and other tools. The patented centers have a distinctive feature which permits operating machines at extremely close tolerances without risk of burned out points, or the necessity of stopping equipment to lubricate centers.

For complete details write Chicago Mfg. & Distributing Co., 1926 W. 46th St., Chicago, Ill.

(Continued from Page 52)

amplifier, which is a specially designed three-stage type, operating from a line voltage of 105 to 125 volt, 60 cycle, AC supply.

By means of setting the step-type attenuator on the amplifier, various degrees of magnification are provided; viz., 40,000 to 1; 4,000 to 1; 400 to 1, etc. A calibrating circuit is also included, which supplies a "test" voltage for adjusting the gain of the amplifier to provide any desired deflection on the oscillograph (recorder) chart. This test voltage is accurately correlated to the sensitivity of the pickup arm.

After being "stepped up" through the amplifier, the voltage is then carried by connecting wires to the direct-inking oscillograph where the voltage is applied to a second piezo-electric crystal, thus causing this crystal to deflect in direct proportion to the stepped-up voltage input.

This second crystal is connected by proper linkage to a pen mechanism which "writes the signature" of the surface on a graph chart. The recorder mechanism for driving the chart is provided with three separate speeds—1/5" per second, 1" per second, and 5" per second, thus making it possible to provide three horizontal magnifications (16 to 1; 80 to 1; and 400 to 1) of the graph without changing the vertical amplitude.

Figure 6 is the result of recording a ground surface. The wide black band at the left of the chart is adjusted to show a 10 mm spacing and is the means of calibrating the amplifier to the sensitivity of the pickup.

Figure 7 illustrates a honed surface. Figure 8 illustrates a super-finished surface. Thus, it may be seen that the general characteristics of the surface can be recorded for future reference, as well as giving an indication of the roughness and, to a certain extent, the wave characteristics of the surface.

The relation between Surface Analyzer chart readings and so-called "RMS" average roughness values may be readily estimated to a high degree of accuracy, or calculated by means of a simple formula if precision is desired. The relative merits of the so-called "RMS" readings and the more accurate indications of chart readings, as well as some interesting attachments for the Surface Analyzer will be discussed in a future issue.

HOW TO SEE ERRORS IN DIMENSIONS.
"Feeling" a tolerance of even .002" is not as quickly determined as by a glance at a needle movement of approximately 7/16".
Visual or Dial Indicator Type Gages enable you to inspect several dimensions simultaneously and to determine the relationship of dimensions with each other. Here concentricity of the outside diameter is checked with the inside diameter. The lower indicator checks the squareness of the end with the axis of the inside diameter and the latter is checked for its own accuracy of diameter, roundness and taper. Try to do this with a "fixed" gage.
FEDERAL PRODUCTS CORP.
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PRECISION MEASURING INSTRUMENTS
Chicago • Cleveland • Detroit • Hartford • Los Angeles • Milwaukee • Montreal • Moncton
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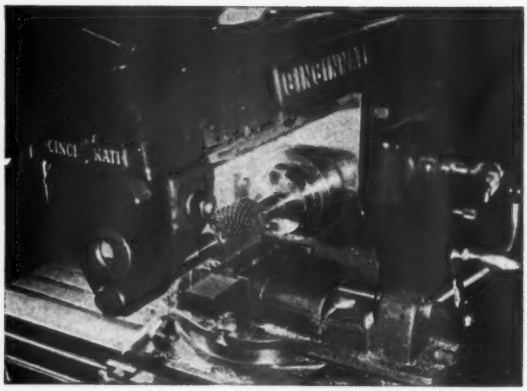

Milling

(Cont. from Page 96)

or double bladed fly cutters should be run at high speed with fine feed. Cutters made from high speed steel are well worth their extra cost.

Where quantities are large, and the amount of material to be removed is small, pieces can often be fed by hand through a high speed wood-working shaper, using Carboloy tool tips.

Turning

As a general rule, tools for cutting phenolic laminate should be ground about the same as for cutting brass, with plenty of clearance to eliminate the abrasive rubbing action characteristic of the laminate. High-speed steel bits will be found very satisfactory for turning, but tools with Carboloy tips will permit much higher speeds and will materially reduce grinding. With such tools the speed is limited only by the machine itself and the feed by the style of finish wanted.

Drilling

The use of high-speed drills is recommended, using the highest speed possible without burning the drill. A ¼" drill should be run at least 2500 RPM for best results and 10,000 RPM would not be excessive for a No. 60 drill. Dubbing the lip of the drill and giving it plenty of clearance will cause it to cut free and will tend to prevent

MAKE-ALL RADIUS DRESSER

You will prefer the MAKE-ALL for simplified *Concave and Convex Radius Dressing* because it is so easy to operate. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.

$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

Distributed by

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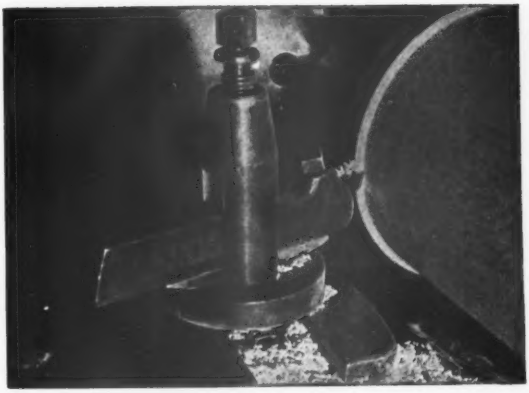
splitting and grabbing. Drills should not be forced and if kept sharp only slight pressure will be necessary.

When drilling, the material has a tendency to bind on the drill and close in when the drill is removed. It is advisable, where tolerances are close, to use a drill a few thousandths larger than the size wanted. It is well to try out the material before ordering jigs to assure correct size of hole. Jigs should be made with a plate beneath the piece to be drilled to prevent breaking out as the drill passes through, drilling perpendicular to the laminations when possible as extra care will be necessary to prevent splitting when drilling parallel to the laminations. In drilling deep holes the drill should be withdrawn three or four times to clear out the chips. The special drills made by most manufacturers, especially for phenolic laminate, have wider clearance grooves and will give much better results than standard metal drills.

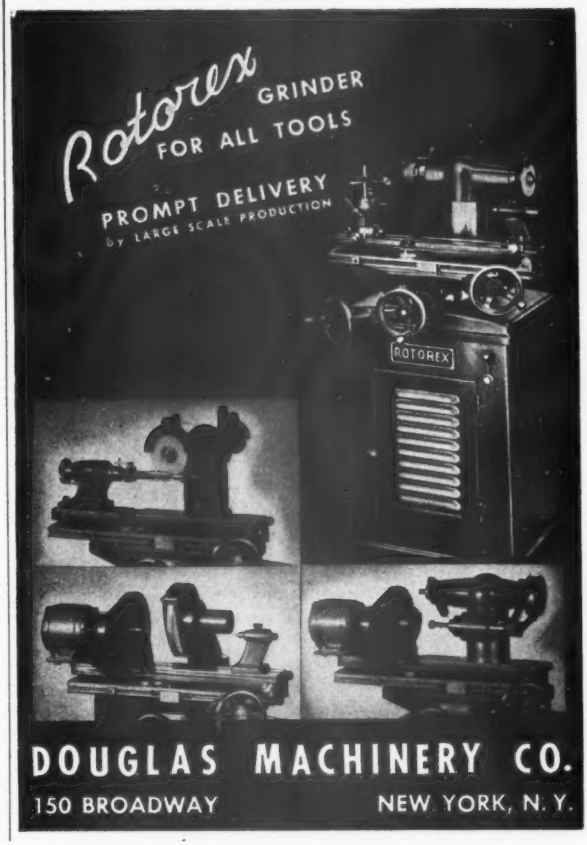
Reaming

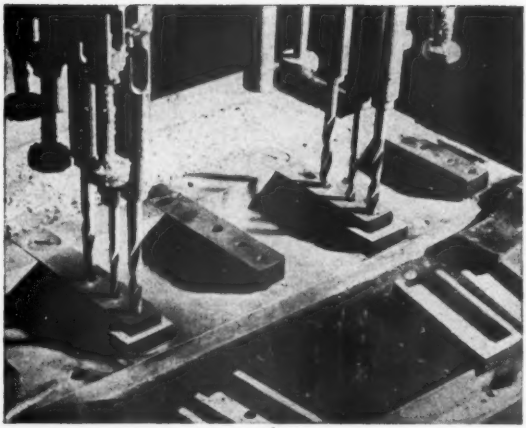
It is difficult to ream phenolic laminate as great care is necessary to prevent dulling of the tool. Fair results can be obtained if an expansion reamer is used in a floating holder which centers itself in the work.

A fast feed is necessary, together with a very slow speed, not



Turning





Drilling

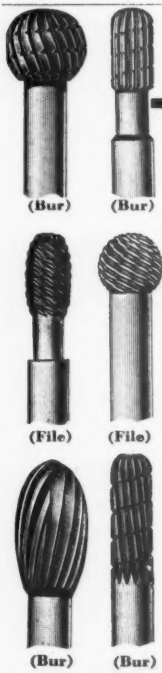
over 50 to 100 RPM. Where close tolerances are required on pieces not over ⅛" thick, good results are obtained by drilling within about .001", and then running a hardened and polished rod through the hole at high speed to give a burnishing effect.

Screw Machine Operations

Tubes, rods, and washers can be successfully machined in automatic and hand-screw machines. It is well to note that tubes are not always exactly concentric, and if concentricity is required it is advisable to specify the tubes a little smaller on the inside or use rod stock and drill concentric. It may occasionally happen that rods turned from sheet stock will work where moulded rods are not found practical. The recommended cutting feeds on automatic screw machines are as follows:

	Per Revolution	
Drilling	.007"	.015"
Turning	.010"	.015"
Cutting Off	.002"	.005"
Forming	.002"	.003"

For trial purposes and for short jobs the cams for Brown & Sharpe Automatics can be economically made from Grade C laminate or Vulcanized Fibre. Water-hardened steel should be used for form tools due to increased hardness and length of runs between grinds. Cut-off tools with Carboloy tips will be found well worth while. The spindle speeds recom-



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Made from High Carbon Steel or High Speed Steel these accurately cut Files and Burs are available in 300 sizes.

Orders are usually shipped within 6 days after being received.

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THE MARTINDALE ELECTRIC CO.

1417 Hird Ave.

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mended for different stock sizes are as follows:

"Hand Screw Machines"

	R.P.M.
1" diameter and over	800/1000
Under 1"	1500/2000

"Automatic Machines"

	R.P.M.
Larger than 5/8" diameter	2500
1/8" to 5/8"	3600
1/8" and under	5000

Threading and Tapping

For large production on threaded jobs, use self-opening dies with high speed circular chasers. Specify circular chasers with extensions in front, as this type will give much longer service than the standard chaser with the large chamfer in front.

The fine threads sometimes required in radio coil forms can be cut to advantage with a V-tool on small bench lathes, equipped with a threading attachment and an expanding collet.

Where only a few pieces are to be threaded, the work can be done in an engine lathe with a V-tool. It may be necessary to make several cuts, filing off all burrs between successive cuts, which should not start more than .007" to .010" deep and lessen as the cut deepens.

In tapping, use high speed taps .002" to .005" oversize. A little oil will help. As many as 3,000 holes can be threaded in ¼" laminate with one 10/32 tap without sharpening. A drill suitable for 75% full thread will facilitate tapping and cut

Screw Machine Operation

STATE
BORING AND
REAMING BARS
Available in six sizes. Boring and Reaming all diameters from 1 1/16" to 5 1/2" inclusive. High speed tool steel or carbide tipped bits optional. Pilots, wear strips, special tapers, etc., available to meet all requirements. Also available in single cutter models.
The wide range and ease of adjustment plus low cost of replacement bits means decreased production charges and greater production output.
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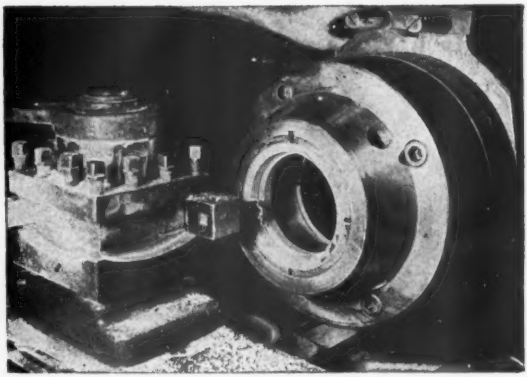


Threading and Tapping

down tap breakage. A slight chamfer around the edge of the hole before tapping will prevent uplift.

For larger holes, over 1¼" or 1½", collapsible taps are available, which will step up production and give very satisfactory results.

Finishing

Should the surface finish be marred or slightly scratched during machining operation, it can be given a dull finish by grinding or sanding with fine abrasive (220 grit) and then buffing with standard cotton buff wheels, using Tripoli or some similar brand of polishing compound. The bright finish can be restored when not scratched too deeply, by buffing with the Tripoli compound without using any abrasive.

Grinding and sanding operations are both practical by means of belt or disc sanding and by centerless or plain grinding. In grinding it is advisable to use plenty of cutting compound, kerosene, or water soluble lubricant, to wash away the grindings and keep the wheels free.

Stamping and Engraving

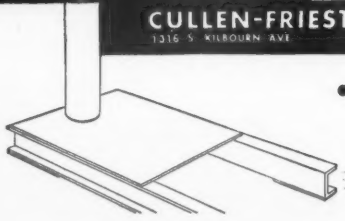
High gloss laminate is surface hard and more difficult to stamp than dull finished stock. Stamping stock must be uniform and should not vary more than .005" in thickness.

Welds all sides *down-hand* with only one set-up

Place the weldment, regardless of size or shape, on a C-F Positioner. "Tack" it to the table and the welder can finish the job alone — can weld all sides down-hand without further crane work or jacking-up. With a C-F Positioner the welder himself rotates, twists and turns the heaviest and most cumbersome weldments with a push-button control — can lay every fillet down-hand, assuring stronger, smoother, flawless welds "all over" easily and quickly.

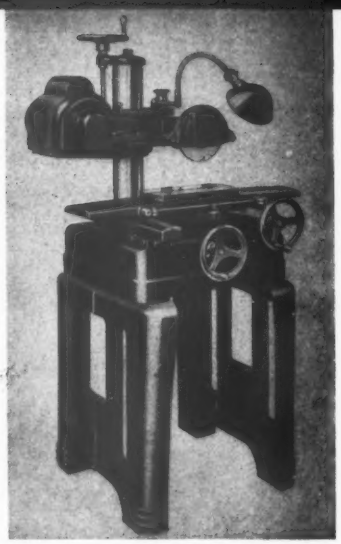
Only the universal, multi-purpose C-F Positioners, both portable and stationary, are pedestal-mounted. The entire positioner can be rotated on its base to give maximum floor clearance or convenience and is adjustable for height. Table rotates full 360° and tilts to 135° from horizontal. Hand or power operated from 1200 lb. capacity up.

CULLEN-FRIESTEDT CO.,
1316 S. KILBOURN AVE. CHICAGO ILLINOIS



Write for new bulletin WP 22

Toolmaker Grinder Has Many Advantages



A STUDY of the design of the new Toolmaker Grinder, recently announced by Delta Mfg. Co., reveals that it is versatile, easy to operate, portable and surprisingly low in cost. Its many advantages make it ideal for the tool room and production shops.

An outstanding design feature is a unique wheel mounting arrangement that utilizes a two-piece adapter so that either wheel, or wheel and adapter, can be removed. Once a wheel has been trued up, it can be removed and replaced with the adapter without any further dressing.

A carefully designed spindle, made extra-long with widely space bearings at either end, provides permanent true alignment. The forward bearing is a large surface taper bronze bearing of a design usually found only in much more expensive grinders. It runs in a continuous bath of oil. A take-up is provided to eliminate all play. The rear bearing is a sealed-for-life bearing that requires no lubrication.

The improved table has long ways so that it never hangs over the end of the machine, but is always riding solidly on the ways. A micrometer collar, with wide graduations on the traverse adjustment permits accurate settings.

A specially designed column of one-piece construction, cast of hi-tensile iron, normalized and accurately ground to close tolerances, is another outstanding feature.

Complete specifications can be obtained from Delta Mfg. Co., 612-L E. Vienna Ave., Milwaukee, Wis.

Not Affected
BY OIL OR HEAT

DE-STA-CO
ARBOR SPACERS

Made of metal, these spacers are not affected by oil, or heat . . . may be used over and over again, thus cost per time used is low. Use these spacers for quick set-up of milling machine cutters and for all low cost, accurate spacing requirements. Stock sizes .001" to .125" thick. Specials, any length, cut from bar stock, ground to decimal.

TRIAL ASSORTMENT—enough for average use on one machine sent for $1.00. Give arbor size. Size and price list sent *FREE!*

DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit, Mich.

Air Clamp Solves Work Problem

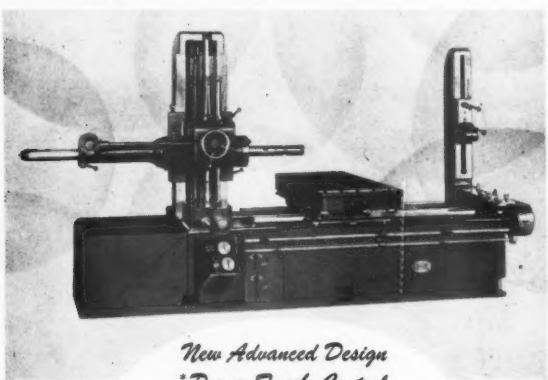
THE following is a work problem solved by the use of the Mead Air Clamp. It was necessary to drill and ream a 1" hole in a boss on a semi-cylindrical iron casting. The work piece consists of half an Air Clamp collar having lugs at both ends which have already been drilled in a jig in order to receive bolts for joining the two halves. These bolt holes are used for locating the casting on the fixture. The fixture is provided with short studs to fit these holes. The mechanism by which pressure is applied to hold the casting to the face of the fixture can readily be seen from the photograph.

A compression post at the top of the fixture is fitted with a hanging arm to which Model V4 Air Clamp applies pressure at the bottom. Between the air clamp ram and the pivot of the hanging arm, a tie rod is attached. This tie rod is secured loosely to the hanging arm.

The end of the tie rod is provided with a cross bar which spans the two lugs on the casting. In operation the ram of the Air Clamp pulls this tie rod toward the face of the fixture. When pressure is released from the Air Clamp the tie rod returns to the open position, allowing clearance above the studs so that the casting can be readily hung on the studs or taken off.

Production on this job was increased approximately 400% over the original method in which threaded studs and wing nuts were

(Con't on Page 160)



New Advanced Design
**Power Touch Control*
Yoder NO. 3A HORIZONTAL BORING MILL

*POWER TOUCH CONTROL completely meets the demand of war production that EVERY MACHINE BE RUN AT THE MOST PRODUCTIVE OF SPEEDS AT ALL TIMES. Every bit of power can be put on tools, up to the last limit of safety. Feeds and speeds of an infinite variety can *flow* at the touch of the control hand. That *power-flow* drive, we call it.

Read all about this feature and many more in the . . .
NEW YODER No. 3A Horizontal Boring Mill BULLETIN.
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The ENGINEERING YODER MANUFACTURING SALES COMPANY
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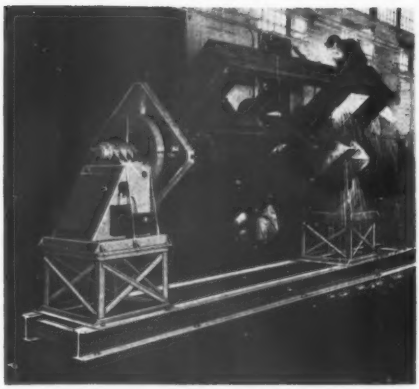
YOU GET THE IMPROVEMENTS FIRST FROM YODER

Position-Welding Possible on Large Objects



ILLUSTRATED is a rotating welding fixture consisting of a head-stock and tail-stock combination for position-welding large cumbersome objects. The head-stock table top is fixed in a vertical position with its spindle shaft turning in double Timken roller bearings. This unit is provided with power for rotating through a pinion in mesh with the table top ring gear.

The tail-stock is essentially of the same design and construction as the head-stock, but is not provided with power and functions as an outboard holding fixture. The distance between the head-stock and tail-stock is made variable to accommodate objects of different lengths by mounting the tail-stock on heavy I-beams and moving it to accommodate the object to be welded. Height adjustment is accomplished by providing simple sub-bases to suit the conditions of service. Both head-stock and tail-stock are of heavy all-welded construction and table tops are T-slotted to facilitate clamping.

Where a difference in elevation between the head-stock and tail-stock units is desired to provide additional downhand welding positions, the main base of the units is pivoted at one end and provided with a hydraulic jack at the other.

Ransome Concrete Machinery Co., Industrial Division "E", Dunellen, N. J., will send descriptive literature at your request.

If you're worried about

DIE SPRINGS

. . . get in touch with us! We carry complete stocks in three standard types, to meet all requirements. Each spring is a precision-made product of the very best material and workmanship, designed for accuracy, resiliency and minimum crystallization. Write for illustrated Catalog.

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We are distributors of the amazing Hardsteel Drills that enable you to drill hardened steel without annealing. See our demonstration at the Metal Show.

DIE SUPPLY CO.

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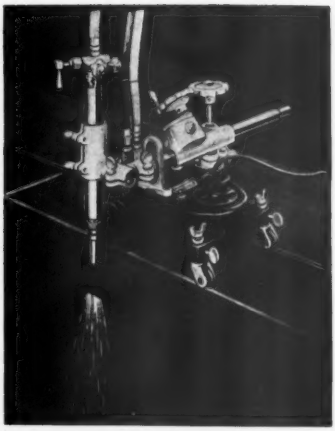

Steel Plates, Billets and Forgings Cut to Close Tolerances

THE No. 5 National portable cutting machine, designed for shop requirements which call for the cutting of steel plates, billets or forgings, holds to close tolerance easily. The smoothness of the cut surface is such that only a minimum amount of machining or grinding is required—in many cases these operations are entirely eliminated. The No. 5 may be used for straightline, straight and bevel, strip, stack, circle, simple irregular and concentric cutting, and billet cropping.

The Torchweld machine cutting torch is precision constructed. A torch bar end bracket and torch holder with calibrated indicator provide easy positioning of the torch for bevel cutting. A hose manifold eliminates hose-drag on torch, thereby preventing a change in torch angle while the cut is in process.

An easy action hand wheel controls the vertical movement of the torch over a range of 2" without changing position of the torch in the holder. Split hair adjustments are possible and are made out of the range of reflected heat from the torch.

The track is of extra heavy cold rolled steel, constructed for absolute rigidity and long life. Rolled surfaces are precision finished to assure accurate machine travel.

The speed range of the No. 5 is 3½" to 50" per minute.

Form No. N-115, giving full information, may be obtained from National Cylinder Gas Co., 207 W. Wacker Drive, Chicago, Ill.

Are Your Plug Gages Accurate

AFTER LONG USE?

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Plug Gages that last twice as long!

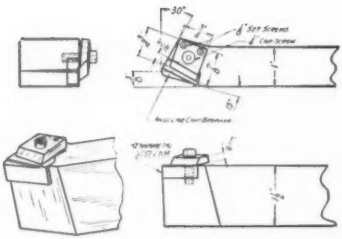
DUBLIFE PLUGS are reversible. When one end of "Go" and "No-Go" Plug is worn from wear, change is quickly made by reversing worn plug. Bronze tapered collet in hexagonal handle securely locks plug as driven in. Reversal means twice the service! *UPPCO* Finish—*"The last word in finish."* All sizes from .030 to 1".

Send for Complete Catalog of DUBLIFE and other Gages of American Gage Design. *Specify DUBLIFE Gages and UPPCO finish.* **Write.**

UNITED PRECISION PRODUCTS CO.

3516 W. Belmont Ave. Chicago, Ill.

Clamped-on Tool Tips Prove Advantageous



SHOPS making up their own carbide cutting tools can greatly simplify the job by using a clamped-on tool.

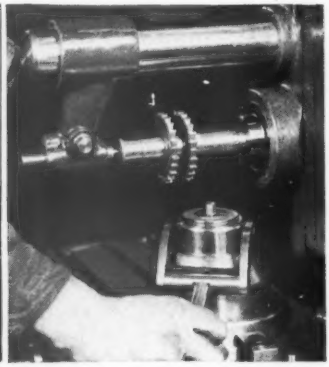
A simple design which has been found very satisfactory is shown in the accompanying sketch. A tool shank is milled out, care being taken to get as flat a surface under the tip as possible, and a simple clamp attached. The SAE 1045 clamp is not used to break the chips as it would soon erode. Instead, a conventional chip breaker of angular shelf type is ground into the Kennametal tip.

Grinding is greatly simplified since only the Kennametal is in contact with the grinding wheel — no steel to load up and glaze the special silicon carbide grit. One such SAE 1045 shank will serve to mount about four successive tips before it becomes cut and battered badly. A harder steel would probably last even longer.

As the tip is reground, it is moved forward and out under the clamp, shims being placed behind it. When the tip becomes too small for service in this tool, it can frequently be brazed into a smaller shank for lighter turning operations or boring. In one plant, the use of clamped-on Kennametal tips made it possible to operate for months without serious tip breakage.

McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa., will supply literature and further details at your request.

The ZAGAR COLLET INDEX FIXTURE Speeds up Holding and Indexing



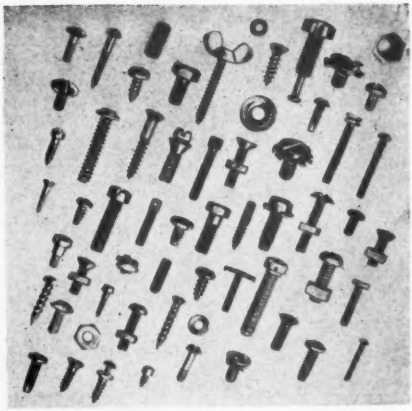
The Zagar Collet Index Fixture can be used on any standard milling machine to mill slots, hexes, keyways, punches, taps, and to perform many other operations.

FOR MILLING, DRILLING, TAPPING, GRINDING, SLOTTING

The Zagar Collet Index Fixture can be adapted to practically any type of collet. It makes hexes, squares, slots, keyways, and holes. Two types: for holding and indexing or for holding only, each in 1" and 2" capacities. One handle opens, closes, and indexes. Any division from 2 to 25. No chip trouble, since the oil comes up through the collet to lubricate and clean out. Easy to set up; extremely simple in design.

Ask for our descriptive Bulletin "D"

ZAGAR TOOL, INC.
23880 Lakeland Blvd. Cleveland, Ohio



Assembly Units Vital For Production

THE trouble-free performance which every reputable manufacturer strives to build into his product depends largely upon the fastenings used in the product's assembly. In consequence, the exacting production requirements and specifications of these vital units of assembly must be met by modern laboratory research.

The Continental Screw Co. maintains a completely equipped laboratory where Holtite fastenings are tested by rigid uncompromising standards throughout every stage of production to insure accurate, uniform and durable performance. A representative group of the fastenings produced are illustrated.

One Holtite fastening innovation — the new "Lock-Tite" screw with the lock washer as a part of the screw—is an original, distinctly different device for metal-to-metal fastening that embodies in one unit advantages of separate lock washer and screw assemblies. As the lock washer is an integral part of the head, this fastening automatically eliminates all lock washer assembling difficulties, lost time and waste. It drives like an ordinary screw.

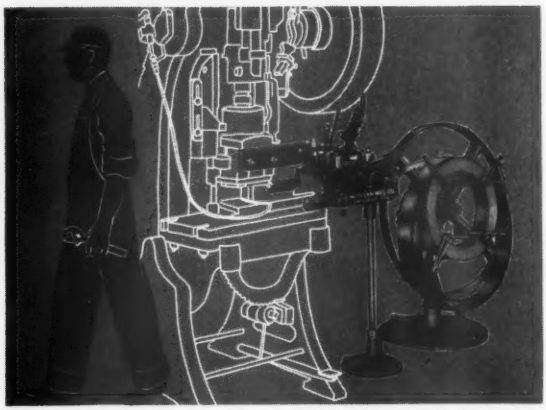
Lock-Tite screws are made to meet the specific needs of the user.

Continental Screw Co., Dept. S, New Bedford, Mass., will send descriptive literature at your request.

WAR PRODUCTION *rolls out faster with*

WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



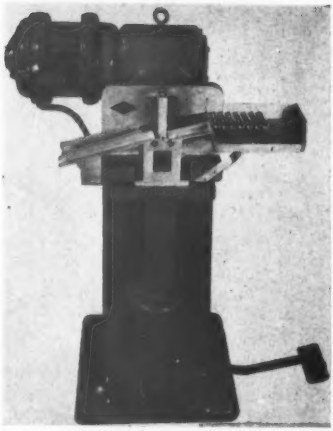
The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

Write for Descriptive Catalog

WITTEK MANUFACTURING CO., 4305 W. 24th Pl., Chicago, Ill.

Speed and Economy Effected by Knurling Machine



A NEWLY perfected knurling machine was recently brought to the attention of wartime manufacturers. Shell manufacturers in particular will benefit by this new machine as it substantially increases the output of knurled shell by replacing lathe knurling—thus taking pressure off the production line.

The keynote of the machine's operation is its extreme simplicity. The unit is semi automatic with a production rate of 1000 pieces and over per hour. Work pieces are fed by hand. The action of the foot treadle brings the work to the knurling roll and then rejects upon retraction.

The machine illustrated is tooled for knurling 20 mm shell. Similar units may be assembled for knurling other cylindrical pieces, ranging in diameter from ¼" to 3". The introduction of this unit at this time is typical of the current trend in production methods.

High production rates require specialized operations. Much knurling which formerly was done on lathes now is being handled by separate knurling machines. Greater speed and economy is effected and the lathe is freed for other jobs.

Wm. A. Force & Co., Inc., 220 Nichols Ave., Brooklyn, N. Y., manufacturers of marking machines and numbering equipment, will send complete information.

FLATNESS and SMOOTHNESS
of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
245 McDOUGALL AVE. · DETROIT, MICH.

Production Increased by Hyper-Milling

INCREASED production rates have resulted from a new method of surface milling recommended by the Firth-Sterling Steel Co. The process uses Firthite sintered carbide tipped inserted blades with both the rake and helix angles of the mills negative up to 10 degrees. The cutters operate at speeds up to 10 times those normally used, with resulting feeds up to 6 times those of conventional high speed mills on hardened alloy steel parts.

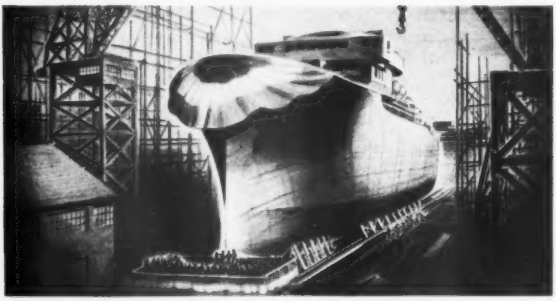
The process, known as hyper-milling, shears the metal off in place of digging it off, as in conventional practice. While the usual milling cutter might be compared to a carpenter's plane which digs into the work, the new method might be compared to a carpenter's scraper in which the angle of the tool is reversed. Hyper-milling results in burnishing the surface of the work being milled, produces less tool wear and keeps both the work and the tool cooler.

Using Firthite T-16 at minimum speeds of 400 fpm with feed per tooth per revolution not in excess of .0015" and depth of cut not in excess of ⅛" production has been increased from 100 percent to 300 percent on a wide range of operations.

It is particularly applicable to hardened, heat treated steels, including alloy steels which present difficult milling problems under conventional methods.

The photograph above is of a hyper-milling cutter in action on annealed, alloy tool steel.

Write Firth-Sterling Steel Co., Dept. TD, McKeesport, Pa., for further information.



STARRETT TOOLS

Are Shortening The Way To The WAYS

One reason your supply house may not be able to furnish all the Starrett Tools you want *when* you want them may be found in the shipyards and marine equipment plants of America.

Making measurements on a ship's propeller fin with a Starrett Steel Beam Trammel.

For there, as on every sector of the production front, you will find countless thousands of Starrett Tools helping skilled hands to do the job better and faster.

The makers of the tools, like the builders of the ships, are bending every effort to meet the demands of the emergency. Should procurement of the proper precision tools prove difficult in your case, bear with us and with our distributor. You may be certain of our intention to deliver Starrett Tools where they will do Uncle Sam the most good.

THE L. S. STARRETT CO., Athol, Massachusetts, U. S. A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Coolant Pump Designed for Continuous Operation

TODAY machine tools are being subjected to the most grueling usage—driven at top speed twenty-four hours a day, often by operators of limited experience. Like every part of these machine tools, coolant pumps must be designed to stand up under this rigorous service without failure.

The flange mounted coolant pump shown in the illustration is a sturdily built unit for use in all machining operations with the exception of grinding. No inlet piping is required and it is easily installed on milling machines, turret lathes and other machne tools by means of four bolts through the heavy vertical mounting flange.

The one-quarter hp motor, with the terminal box built into the end bell, is totally enclosed against dirt, vapor or short circuiting by splashing liquids and is designed for continuous operation without overheating.

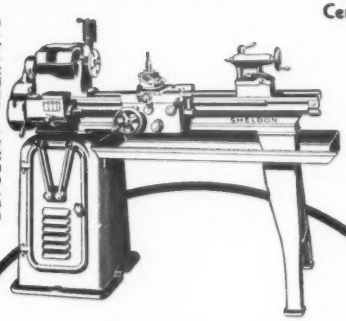
This pump is self priming and delivers coolant the moment it begins to operate. It will handle liquids charged with filings and chips as large as thirty-five thousandths without stoppage or damage and its construction prevents trapping of air. Any commercial coolant can be circulated in quantities ranging from a fraction of a gallon to approximately 17 gallons per minute free flow.

Write for folder P-325 for specifications. Address Gilbert and Barker Mfg. Co., Cold Springs Ave., W. Springfield, Mass.

SHELDON

LATHE
No. U-1236 WQ
12¼" Swing, 36" Center Distance

*The Sheldon U-type underneath Motor Drive is a 4-speed V-belt drive, enclosed in the pedestal base leg. Speed changes are made instantaneously by external shift levers which operate clutches. Available with all Sheldon Lathes.



This is a quality precision lathe with large special analysis steel spindle ground all over and 1" round collet capacity. Hand scraped bronze spindle Bearings. (Also available with Ultra-Precision Ball or Super-Precision Roller spindle bearings), Full Quick-Change Gears. Double-walled Worm Feed Apron with Power Cross Feed, Heavy strutted and cross-braced semi-steel bed with hand scraped ways (2 V-ways and 2 flat ways) and U-type Lever-operated 4 speed Motor Drive.

SHELDON MACHINE CO., Inc.
4236 No. Knox Ave., CHICAGO, U.S.A.

Unit Combines Three Handling Features

A NEW power industrial transportation unit performs not only the separate functions of a load carrier, a crane and a tractor, but also combines the typical operations of all three.

As a load carrier, the mobile unit has an unobstructed platform 84" long x 40" wide x 25" high, with a rated capacity of 6,000 lbs. As a crane handling up to 2,000 lbs. at 42" on the boom, it lifts and transports castings or other heavy, bulky objects. As a tractor, it first loads the trailers by means of its own crane, then hauls them at speeds up to 5 mph.

The truck operates with 2-wheel drive and 4-wheel steer. The frame is made of heavy section formed plates welded into a rugged one-piece structural unit embodying the control dash. The boom is of special design—of heavy formed channel members rigidly reinforced with tie rods, lattice bars and gusset plates and slews around a 3½" diameter alloy steel pillar. Thrust load is taken on oversize ball bearings at the base of column; radial loads on roller bearings at both top and bottom.

Listed under the Underwriters' Laboratories' re-examination service, the design further embodies such features as: widely spread stabilizing compound coil springs on drive and trail axle; equal length full floating drive shafts; and Elwell-Parker heavy duty motors.

Address The Elwell-Parker Electric Co., Cleveland, O., for further information.

-75°F

TO KILL GROWTH OF PRECISION GAUGES

TO INSURE ACCURATE CALIBRATION OF AVIATION EQUIPMENT

TO IMPROVE CHILL SHRINK FITS

THE NEW REVCO INDUSTRIAL *CHILL CHEST*

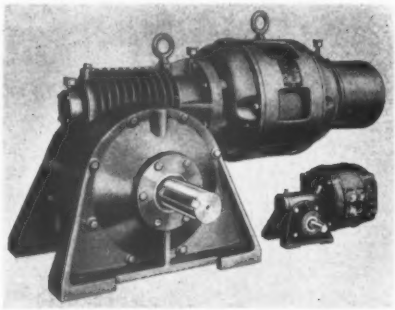
In this compact and sturdy Chill Chest Revco offers new accuracy and precision in testing and calibration of aviation materials. Revco engineers specialize in custom-built industrial refrigeration equipment.

Write today for further information.

REVCO, INC., Adrian, Michigan

Speed Reducer Lowers Maintenance Expense

JANETTE speed reducers are claimed to be economical in low first cost, ease of installation, efficiency of current consumption and low maintenance expense. Because of their compactness, it is usually possible for Janette reducers to be installed in the same space as ordinary standard motors. By using reducers, lower operating speeds can be secured than by using direct-connected slow speed motors. If a different speed than originally furnished is desired, the necessary gears for the change can be supplied at a small proportion of the initial cost of the unit.

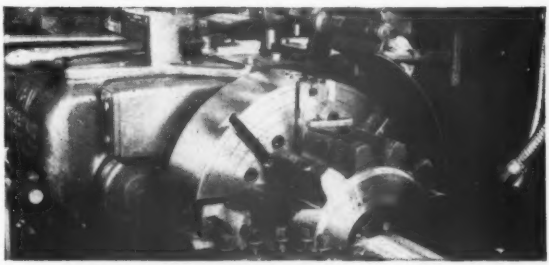


The reducer housings, covers and bearing end caps are made from high grade, close grained, grey cast iron with .25 percent nickel. All pressed fits in the gears and bearings are secured by grinding the shaft seats and reaming the bores to close limits. All shaft fillets are of the largest possible radius in order to assure an even stress. The standard countershaft extensions are proportioned to accommodate standard commercial couplings, gears, pulleys, sprockets, sheaves, or cranks of sizes large enough to transmit the corresponding torques.

The direction of rotation is clockwise or counter-clockwise, looking at the end of the countershaft. If the reducer has a double countershaft, the direction of rotation is taken looking at the end of the right hand countershaft, viewed from the gear box end.

Bulletin 22-25C may be had by writing Janette Mfg. Co., 554 W. Monroe St., Chicago, Ill.

KNOW YOUR TOOLS WILL *— take the cut*



Use KENNAMETAL*

KENNAMETAL not only handles the run-of-the-shop turning, boring, and facing operations at greater machining speeds, but it efficiently handles jobs on which other carbides fail.

KENNAMETAL'S great strength permits jump cuts . . . it has a transverse rupture strength of 305,000 lbs./sq. inch.

KENNAMETAL machines steel up to 55C Brinell hardness and is superior to other carbides in strength, hardness, and crater-resistance.

Write for the Vest Pocket Manual which contains complete information about this superior cutting carbide.

Style 6

Style 11

*INVENTED AND MANUFACTURED IN U.S.A.

McKENNA METALS Co.

500 LLOYD AVENUE, LATROBE, PENNA.

Foreign Sales: U.S. STEEL EXPORT CO., 30 Church St., New York
Exclusive of Canada and Great Britain

Trade Mark Reg. U.S. Pat. Off.

New Binocular Eye Shade Gives Third Dimension Vision

SOME of the largest industries in the United States are now using the new Magni-Focuser

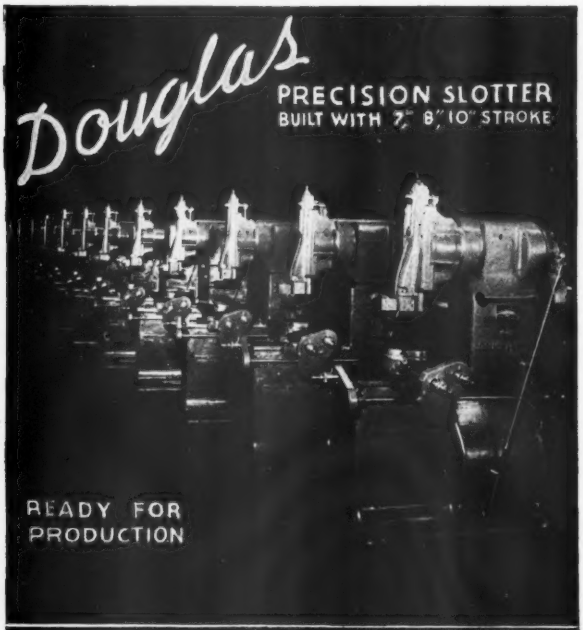
binocular eye shade. The use of this eye shade makes it possible to set up small tools more quickly; to check short, delicate drilling or reaming cycles; for inspection and other operations where a magnified third dimensional view is an advantage.

The dual-mounted lenses, ground from the finest optical glass, give third dimension vision which is impossible with a "one-eyed loop". The magnification of an object to needle-point sharpness is obtained approximately three times its actual size. Prisms in each lens relieve eye-strain and the shade shuts out all glare. Its feather weight gives convenience, comfort and freedom of using both hands.

The lenses are set so that a slight tilt of the head permits the operator to look beneath the shade with his normal vision. The eye shade is strongly made of a plastics material for protection against flying chips or particles.

N. L. Huebsch, selling agent for the Magni-Focuser eye shade, will send one or more for a ten-day trial period. If not entirely satisfied, your money will be refunded.

For full particulars about the Magni-Focuser binocular eye shade write N. L. Huebsch, Selling Agent, 81 Yale St., Dept. TD, E. Williston, N. Y.



SWIVELING RAM HEAD AND TOOL HOLDER, AUTOMATIC CIRCULAR TABLE AND INDEPENDENT AUTOMATIC FEEDS IN ALL DIRECTIONS

EARLY DELIVERY BY LARGE SCALE PRODUCTION

DOUGLAS MACHINERY CO. INC.
150 BROADWAY NEW YORK, N. Y.

Finger Tip Control Reduces Drill Breakage

A NEW super sensitive high speed drill press for extremely small drills and other tools has been announced by The Edward Blake Co. The machine has a standard range of eight speeds from 3000 to 23,000 rpm, which gives the proper surface speeds on drills from .004" or smaller to $\frac{1}{8}$" in diameter.

Sensitivity is attained by balancing the spindle by means of the vertical component of the belt tension. This sensitivity, plus convenient finger tip control, reduces drill breakage to a minimum. The needle bearing construction of the drilling head allows both axial and vertical motion of the spindle. The spindle is thus floating in its bearings and is more highly sensitive than any other type of construction.

Low and high speed ranges are obtained by changing the V-belt on the motor drive. Four intermediate speed changes may be made by changing the spindle drive belt on the countershaft and spindle. The countershaft and idler pulleys are perfectly balanced and mounted in anti-friction ball bearings. This makes a complete vibrationless assembly resulting in drilling accuracy.

Machines of one, two, three and four spindles may be furnished. Each spindle may be run at an independent speed to suit the size and type of tool being used and the material to be cut. Standard equipment includes two spindles for each spindle mount.

The Edward Blake Co., 636 Commonwealth Ave., Newton Centre, Mass., will send a new bulletin containing further information at your request.

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

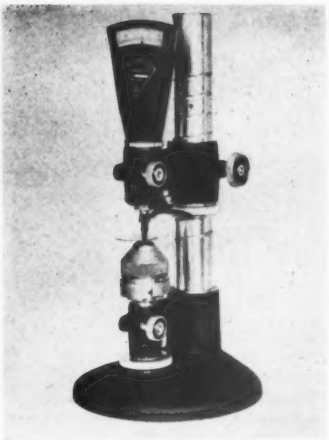
DIE TABLE Filing From Below

PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this universal machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

MARBURG BROTHERS, INC.
Exclusive Distributors
90 West Street New York, N. Y.



Small Shims Gaged Accurately with Ball Measuring Anvil

THE George Scherr Company has just developed a ball measuring anvil for use on the Scherr Comparitol designed to speed up, simplify and guarantee accuracy for the measurement of extremely thin pieces such as crystals, laminations, shims, small gages and other flat work.

With the ball anvil, the work is placed between the flat feeler point and the round ball surface and absolutely dependable results are obtained regardless of which part of the thin piece under inspection is being measured. All danger of distorting or bending the shim or lamination out of size a few ten-thousandths due to measuring pressure of the instrument is eliminated.

Another outstanding feature is that with the use of the ball anvil, the instrument may be used to check the flatness or parallelism of long thin pieces in all positions and on all parts of the work.

The Comparitol column, when used with this ball anvil, is provided with an index line so that the ball point and feeler point can be lined up accurately from left to right as to center distance.

Full information may be had from George Scherr Co., 128-B Lafayette St., New York, N. Y.

(Con't from Page 148)

used to hold the casting to the face of the fixture.

Address Mead Specialties Co., 15 S. Market St., Dept. 29, Chicago, Ill., for descriptive literature.

SCIENCE *will win the* **WAR!**

Our Services

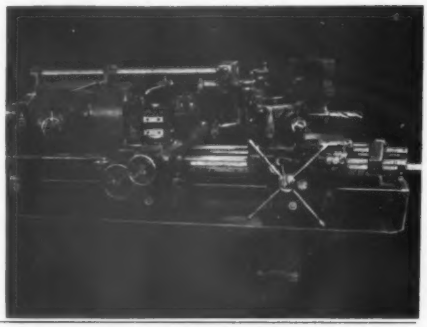
Flame Hardening · Annealing · Aerocasing · Bar Stock Treating and Straightening · Heat Treating · Pack or Gas Carburizing · Sand Blasting · Chapmanizing · Tempering · Cyaniding · Nitriding · Hi-Speed Hardening

METAL TREATING INSTITUTE

THE LAKESIDE STEEL IMPROVEMENT CO.

5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

Heavy Walled Turrets Support Boring Bars Without Pilot



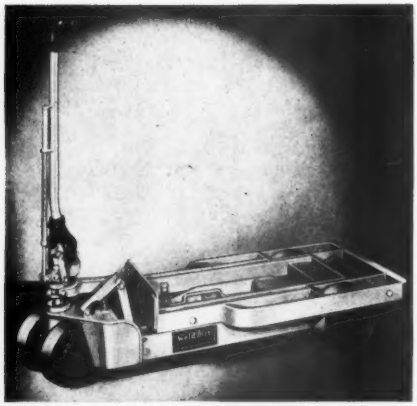
AFTER extensive research and experimentation the Jones & Lamson Machine Co. has put into production its new 9A and 10A Saddle type universal turret lathes. Notable among the cost-reducing, labor-saving features that have been added is power traversing of the saddle and power indexing of the hexagon turret both operated by one lever, through which both high and low positive traversing speeds can be obtained.

Power traversing and power indexing of the hexagon turret has allowed the No. 9A and 10A machines to be provided with particularly heavy walled turrets that allow bigger than normal boring bars to be supported without need for pilots.

Another important and predominating feature is the massive design of both these machines. The bed is of an improved double-wall, box-ribbed design and is 17" across the ways on the No. 9A machine and 20" across the ways on the No. 10A machine. This gives greater strength and a solid, rigid support for both carriage and saddle.

Still another outstanding labor and time-saving feature is the built-in power rapid traverse for the bridge-type carriage and cross slide. This power rapid traverse has an all-gear drive and is operated by a single lever, through which all four movements of the carriage and cross slide, or a combination of

(Con't on Page 162)



Heavy Loads Handled Efficiently

FILLING out their present line of Weld-Bilt Hydraulic lift trucks, West Bend Equipment Corp. recently announced the development of a new 10,000 pound capacity Weld-Bilt hydraulic lift truck, Model L.

Designed and built for easy mobility and greater efficiency in handling extremely heavy loads, this model has all the standard Weld-Bilt features, including the shock-proof horizontally mounted hydraulic unit. This unit is interchangeable, easily removed without special tools, permitting easy replacement after years of service.

Made in both narrow and wide platform sizes, the Model L lift truck has frames, wheels and lifting mechanism of extra heavy construction, capable of much heavier loads than the specified rating. Moving parts are equipped with ball or roller bearings for easy handling. Steel frames are arc-welded and heavily cross-braced for extra rigidity and strength.

Bulletin No. 242-J may be obtained from West Bend Equipment Corp., West Bend, Wis.

DIEBEL Hi-Speed STAMPING PRESS

So completely automatic—so amazingly simple in design—so wholly safe to operate—so absolutely foolproof — one woman operator can handle a single Diebel Press or a battery of them, even with other duties. **Saves your skilled mechanics.**

Top production speed — 550 a minute — skyrockets production; slashes costs. Variable speed control from 180 to 550 strokes per minute.

QUICK DELIVERY - - - WRITE FOR BULLETIN

DI MACHINE CORP.
DIVISION OF DIEBEL DIE & MFG. CO.
3653 N. LINCOLN AVE. CHICAGO

(Con't from Page 161)

these movements, can be obtained. This feature eliminates some of the tiresome hand cranking, allowing multiple tooling on both front and rear of the cross slide to be used to the greatest possible advantage.

Jones and Lamson Machine Co., Springfield, Vt., will send their new Bulletin 9A at your request.

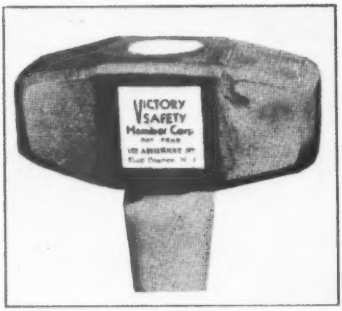
New Hammer Design Has Safety Features

TO meet industry's demand for safety for its workers, the Victory-Safety Hammer Corp. has designed a soft metal hammer that cups instead of mushrooming and that does not flake because of the alloy used.

Victory-Safety hammers are cast in one piece of a soft metal alloy with a hollow center. The hitting face is twice the thickness of the side walls. This feature permits the hitting face to set in or cup; the side walls to swell outward, preventing mushrooming and its dangers.

These hammers hold their balance throughout their useful life. They do not mar or dent machine tool fixtures, jigs or work in production.

Safety engineers state that annually large compensation losses, slowed down production and scarred, blinded or otherwise injured workers result from accidents due to chipping, flaking and mushrooming hammers. Various standard sizes, weights and degrees of softness are available. Victory-Safety hammers will meet every shop use.



Descriptive literature containing Specifications and prices may be obtained from Victory-Safety Hammer Corp., 122-V Amherst St., E. Orange, N. J.

★★★★★★★★★★★★★★★★★★
★ ALL ABRASIVES ★
★ GRADES and GRAINS ★
★ READY FOR ★
★ SHIPMENT! ★
★★★★★★★★★★★★★★★★★★

NATIONAL MOUNTED WHEELS

There's a National Wheel for the most difficult jobs. From snagging out-of-the-way parts of tanks to the most intricate cartridge dies . . . National Wheels are best! Many different diameters and lengths of shanks are available for all abrasives, grains and grades. Contact our office nearest you for complete information on National Grinding Wheels.

TRY ONE FREE!

. . . Tell us the kind of job, size and wheel speed, and we'll send a test wheel, postpaid.

MANUFACTURERS SUPPLY COMPANY
2640 CARNEGIE AVENUE
CLEVELAND, OHIO

CINCINNATI: WM. BUCHANAN SUPPLY CO., 339 E. 3rd ST.
YOUNGSTOWN: C. H. WILTSIE, 4177 OAK KNOLL DR.
ELLWOOD CITY, PA.: JOHN S. FISHER, 9 FIFTH AVE.
PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

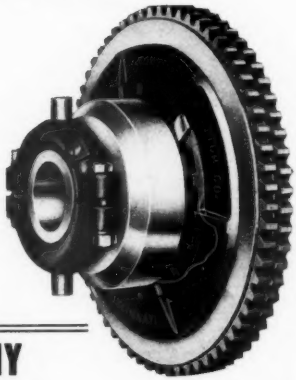
drag-free idling

featured in

CONWAY CLUTCHES

The sturdy construction of Conway Clutches provides for extreme stresses. Complete enclosure delivers safety, neatness and balance. All parts are designed and machined within contour of the whole clutch.

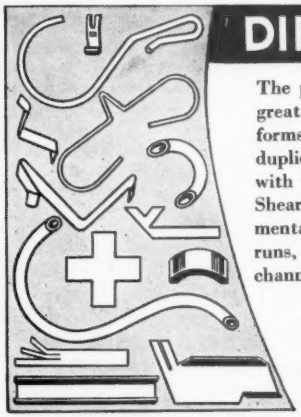
Each size clutch in the Conway line has levers especially designed for its specific range of power and service. Each set of plates is separated by independent springs, *insuring drag-free idling—an exclusive Conway feature.*



CONWAY CLUTCH COMPANY

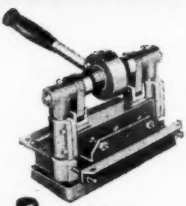
P. O. Station B ★ **Cincinnati, Ohio**

Patented in U.S.A. and Canada

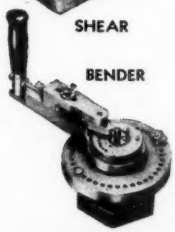


DIE-LESS DUPLICATING

The parts shown are typical of the great variety of simple or intricate forms and shapes which can be quickly duplicated to a tolerance of .001" with DI-ACRO Precision Machines—Shears, Brakes, Benders. For experimental and research work or production runs, DI-ACRO Units form angle, channel, tube, rod, moulding, wire, strip stock; shear stock sheets; trim duplicated stampings. With DIE-LESS DUPLICATING, die expense and time delay are frequently saved.

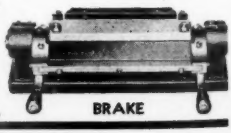


SHEAR



BENDER

WRITE FOR CATALOG — Send today for new 32-page catalog—"Metal Duplicating Without Dies"—giving full information on the capacity of Di-Acro Shears, Brakes, and Benders and illustrating their great variety of applications.



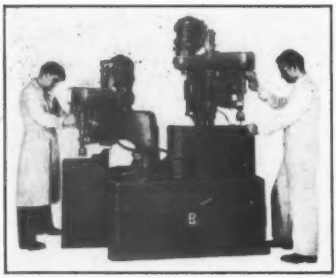
BRAKE

DI-ACRO "THE MECHANICS' METHUSELAH" PRECISION MACHINES

O'NEIL - IRWIN MFG. CO.

315 - 8th Ave. S. **Minneapolis, Minn.**

Bakewell Eliminates Second Tapping



DESIGNED with the idea of increasing production in precision tapping and threading, the Bakewell eliminates the necessity of second tapping to insure perfect threading. Class 3 and 4 gage fits can now be had on a production basis without rejections.

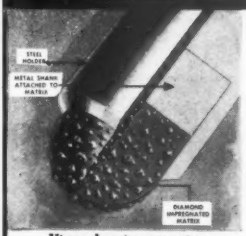
The table, with its 28½" x 46" working surface, is 32" from the floor level and provides ample support for large pieces to be tapped. There is also a vertical T-slotted table on the left hand side of the base to which an angle plate can be attached. In case of extremely long work, a pit may be let into the floor below the vertical table. Provision is made for attaching an additional work table at the rear of the machine. This feature is advantageous where two tapping heads are provided, as it permits using each spindle and tap on a different job, each mounted on its own vertical table. (See illustration.)

The use of the radial arm makes possible the moving of the tap around the work rather than the work around the tap, speeding up production. The tap may be brought quickly from one hole to the next and located without guide fixtures.

Perfect threads are cut in plastics, aluminum and its alloys, magnesium, bronze, diecasting, nickel and stainless steels and chrome - molybdenum alloys. The Bakewell tapper will cut either internal or external threads with equal facility and right or left hand threads as desired.

Bakewell Mfg. Co., 2431 E. 14th St., Los Angeles, Cal., will send a new catalog on request.

THE ANSWER TO YOUR DRESSER PROBLEM



View showing quarter section of dresser.

The answer to your wheel dressing problem—Carboloy diamond impregnated dressers. In stock and ready for immediate delivery—these dressers require no resetting—afford you 90% diamond utilization with no fear of diamond loss—stand unusual abuse—and save at least 25% in annual dresser costs.

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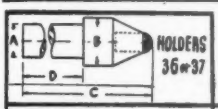
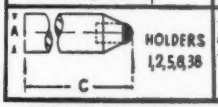
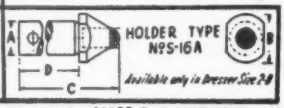
Up to 20"	Up to 1½"	2-B	$ 9.60
Up to 26"	Up to 2½"	3-C	12.60
Up to 42"	Up to 8"	4-D	15.35

*Mounted Free in Desired Holder. Standard Holders shown below. Special Types when needed. Allow 1 Week—10 days for holders No. 37, 38, and S-16-A.



Holder Number	1	2	5	8	36	37	38	S-16-A
A	7/16	1/2	1/2	7/16	7/16	1/2	7/16	7/16
B					1/2	1/2		1/2
C	1 1/2	1 1/2	4	1 1/4	2 1/2	2 1/2	3 1/2	1 1/2
D					1 1/4	1 1/4		11/16





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Today's demands for precision and strength only emphasize the fact that Mac-its always have been made as accurate and strong as possible.
The Mac-it process plus perpetual testing and skilled heat treatment produces screws that meet the strict specifications of Victory tools and weapons.
Whenever your production calls for utmost Precision and Strength in holding-together or holding-down jobs . . .
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STRONG, CARLISLE & HAMMOND COMPANY
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TIME SAVER

These interchangeable steel type and holder make part number changes a simple operation. Turn a screw to make the change. Guaranteed for years of service. Used by hand or press, it's a time and money saver.

These are stock sizes.

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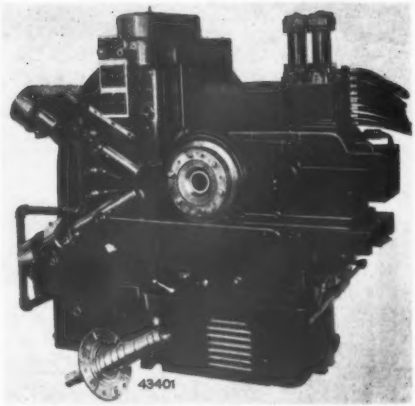

TYPICAL of the efficiency with which special machines are being engineered to solve complex processing problems in the aircraft industry is this rotary milling machine used in milling an undercut in the circular shoulder section of a turned propeller shaft hub to produce six elevated rest pads. The entire processing operation is fully automatic except for the throwing of a lever between first and second cycles.

With the work piece loaded and clamped in position hydraulically, the first cycle starts with the entire fixture assembly and work piece moving automatically along the main slide into milling position. A transverse sub-slide feeds the work piece to the tools until the required cutting depth is reached. The piece is then rotated through the specified cutting arc.

On completion of the first three cuts, the fixture retracts and rotates the work piece 180° into position for the second three cuts, which complete the roughing operation.

When the six rough cuts have been made, the fixture again retracts and the entire fixture assembly moves along the main slide, permitting the operator to inspect cutters and finish. The operator then throws a small lever which starts the machine through an identical second cycle in which the finish cut is made.

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ATLANTIC

No. 2 Automatic Precision

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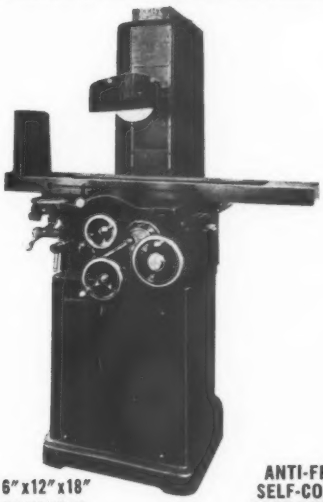

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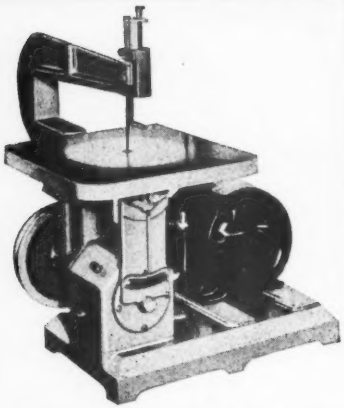

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The holddown fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

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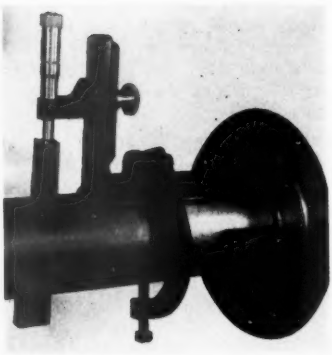

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ENGINEERING DRAWING & MECHANISM—This book is designed to provide the student with a fundamental working knowledge of drafting and the use of drafting tools. The first part of the book consists of exercises in vertical lettering, the use of instruments, the techniques of presenting ideas in graphic fashion and the conventions of machine drawing. The second part of the book is built around the study of various types of mechanisms and of their importance to machine design. On completion of this book the student should be able to make drawings of cams and gears, linkages and quick-return motions, that are correct and easily understood. The author is Harold J. Brodie, Price $2.25.

MOUNTED WHEEL MANUAL—a new manual published by the Chicago Wheel & Mfg. Co. features colored illustrations of the product. All types of mounted wheels and a wide variety of portable tool accessories are shown. The comprehensive booklet points out many time-saving ideas on the use of portable tools and mounted wheels. This should prove a valuable addition to every shop library.

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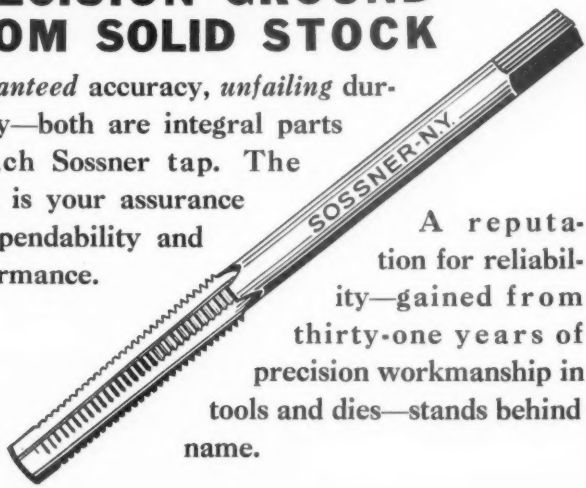

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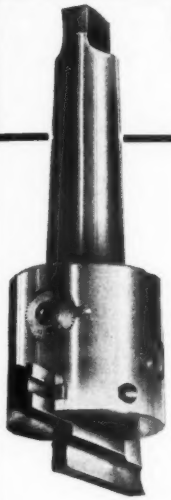

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Precision tapping on a production basis. Class 3 and 4 specifications easily met. A high quality machine with 4 speeds 95 to 395 RPM and dial indicator for bottom tapping. Ball bearings throughout. Equipped with coolant pump system. No skilled operators necessary — sensitive touch — minimizes "rejects".

INTERNATIONAL INSIDE MICROMETERS
Highest Accuracy and Finest Workmanship

Available in 2 sets: 1½" —6" and 1½" —12" including case and handle. Accuracy unconditionally guaranteed. M & L POSITIVE OFFSET BORING HEAD 0-15". New "HANDY KNURLER", used like pair of pliers. BRAND TELESCOPE GAGES ½"—2⅛" capacity—are a few of the many tools available from the Brand Tool and Supply Company. Write for complete information—NOW!

Immediate Delivery — Satisfaction guaranteed

BRAND TOOL & SUPPLY CO.
formerly Pacific Tool & Supply Co.
346 N. Vermont Ave., Los Angeles, Cal.

DARWIN STEELS
Stand for Quality

We were the Originators of HIGH CARBON-HIGH CHROME Steels with NON-DEFORMING Qualities, opening the way to

Quantity Production
for all kinds of Dies and Press Tools with High Carbon-High Chrome Steel

Oil-Hardening
"NEOR"
and
Air-Hardening
"COBALTCROM-PRK"
—the latter also in CAST FORM

have become the STANDARD on which all subsequent similar kinds of Steel were based.

We supply also
High Speed Steels
in Bars, Forgings, Tool-Bits
as well as all types of
High Grade Tool Steels
Write for descriptive Circulars

See us at
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National Metal Exposition
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DARWIN & MILNER, Inc.
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CERROMATRIX (Melting Temp., 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, for engraving machine models, stripper plates, chucks, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp., 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

These two low-temperature-melting and expanding alloys are helping to speed up production of war materials for the Army, Navy and Air Force.

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40 WALL STREET - - - - NEW YORK, N. Y.

PORTABLE ELECTRIC HONING and FILING TOOL

(RECIPROCATING ACTION)

ELIMINATES HAND OPERATIONS!

MODEL C—3/8" STROKE
MODEL E—1/8" STROKE

Conserves time and energy by mechanically reproducing the natural push and pull action of hand operations . . . filing, honing, polishing, sanding, sawing, etc. . . . when equipped with the proper accessories. Will prove a boon to every Tool, Die, Mold, and Machine Shop.

Prompt delivery from stock!

Just off the press—Precision Production Tool Catalog No. 42

ACME TOOL COMPANY 200 CHURCH STREET NEW YORK, N. Y.

Rawhide HAMMERS *Rawhide* MALLETS

• Genuine Java Water Buffalo Hide replaceable faces in malleable head.

No.	Dia. in ins.	Wgt. in lbs.
0	1	½
1	1¼	1⅛
2	1½	1⅜
3	1¾	2¼
4	2	4
5	2¾	5½

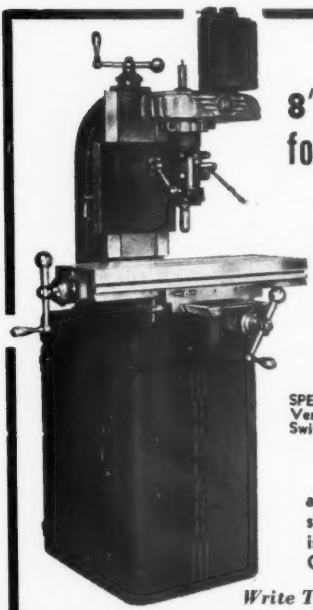
• A finely balanced Tool with tough, resilient Java Water Buffalo Rawhide heads.

Not Loaded				Loaded Mallets			
No.	Dia. Ins.	Lgt. Ins.	Wt. Ozs.	No.	Dia. Ins.	Lgt. Ins.	Wt. Ozs.
0	1	2⅛	2	7	1¼	3	8
1	1¼	3	3½	8	1½	3⅛	12
2	1½	3¼	6	9	1¾	3⅝	16
3	1¾	3¼	7½	10	2	3½	20
4	2	3½	10	11	2¾	4¼	42
5	2¾	4¼	21				
6	2¾	4¾	23				

• These are the tough, resilient, long-lasting Rawhide faces made from specially treated Java Water Buffalo hide for use in Chicago Rawhide Hammers.

CHICAGO *Rawhide* MFG. CO.

1280 ELSTON AVE.. ★ CHICAGO. ILLINOIS.



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8" x 16" VERTICAL MILLER for AIRCRAFT PARTS PRODUCTION

THIS rugged miller is widely used in aircraft and armament plants, as well as toolrooms. The high-speed head, a self-contained motor-driven unit, can be turned to any angle parallel with the longitudinal feed. Compact design, with extra large handles and convenient controls, make the Holland Miller ideal for small parts such as the shackle shown below.

Chrome-plated quill has lever feed. Large feed dials for easy reading. Spindle mounted on precision pre-loaded ball bearings.

SPECIFICATIONS: Table Size, 8" x 26"; Table Range, 8" x 16"; Vertical Feeds, 3" on Quill, 8" on Quill Head; Collet Capacity, ½". Swivel Head graduated to 90° left and right. Dial Graduations in .001".

Boring, End-Milling and Slotting on shackles and similar production parts finished faster on the Holland. Compare!

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(DIVISION OF ASSOCIATED SPRING CORPORATION)

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Federal Taperlock Gage Handles are accurately made of plastic materials, to accepted standard dimensions. Lighter in weight than aluminum or other metals, they perform in the same way . . . . and save metals for other important uses.

They are durable, and the cost is surprisingly low.

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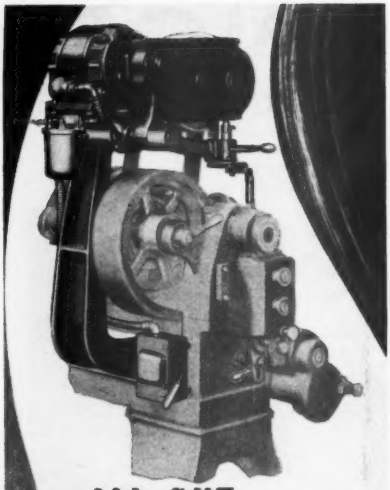

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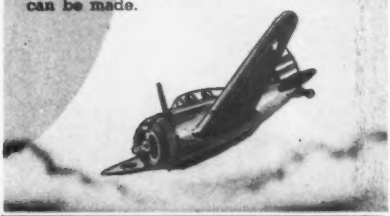

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Send for literature describing the line of Oliver Die Making Machines!

We also build Drill Grinders, Tool and Cutter Grinders, Face Mill Grinders, Template Tool Bit Grinders.

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Boyar-Schultz Copper Head Laps are highly recommended for lapping holes accurately and economically.

They are economical because they last a long time. The only wearing part is the adjustable copper sleeve which is quickly replaced when worn with a new sleeve of correct size. They are less costly than making your own laps.

Available in sizes ⅛" to 2½" and carried in stock.

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specifically designed for industrial use—

PRECISELY engineered to meet increased demand for dependable rectifiers . . . In a range of 42 models — from 125 to 3000 watts capacity.

SIMPLE in operation. COMPACT — can be built directly into your equipment. Many other features.

With the NEW AUTOMATIC TIME DELAY SWITCH (in larger units) to protect rectifier tubes. A "money saver and production increaser —" prevents throwing the load on tubes until properly warmed up, etc.

NEW BULLETIN "61" gives complete information. WRITE for your copy.

ELECTRO-MATIC PRODUCTS CO.
Makers: NEUTROL Electric-magnetic Chuck Control
2235-37 North Knox Ave. Chicago, Illinois

PUBLICATION PREVIEWS

Sales and Technical Literature

Send Request on Company Letterhead

ELECTRO-MATIC RECTIFIERS—provide a dependable source of direct current from alternating current supply. The new Electro-Matic Time Delay Switch, installed in the rectifier, protects rectifier tubes, eliminating constant tube replacement and frequent shutdowns. Bulletin 21, issued by Electro-Matic Products Co., 2235-37 N. Knox Ave., Chicago, Ill., contains complete description and a table giving rectifier voltage combinations. A wiring diagram of the Neutrol magnetic chuck control and rectifier will prove of interest.

CIRCULAR RELIEF GRINDING—The Cleveland Tool Engr. Co., 9203 Detroit Ave., Cleveland, O., has available an interesting folder describing their method of relief grinding. A spread of actual shop photographs show some of the many applications of this method of performing circular relief grinding. Send for your copy.

PRECISION COLLETS—A 4-page folder lists machines using draw-in collets and contains tables of capacities and dimensions to facilitate ordering and delivery. A line drawing is included to insure accuracy of dimensions. This folder is available from Precision Collet Co., 266 Canal St., New York, New York.

YOST VISES—Described and illustrated in Catalog No. J-11 is the complete line manufactured by Yost Mfg. Co., Meadville, Pa., which includes drill press vises, toolmakers vises, quick acting vises, utility vises, etc. Complete specifications and prices are given.

COLD SAWING MACHINES—Bulletin 100 contains a brief outline of the design and construction features of Motch and Merryweather hydraulic feed cold sawing machines. Some of the features include ruggedly constructed, self-contained saw carriage housing the entire drive to the saw blade; nine speed changes in geometrical progression, developing cutting speeds from 18 fpm to 134 fpm; and a low pressure type hydraulic feed, consisting of motor, pump and valves. Motch and Merryweather Machy. Co., 715 Penton Bldg., Cleveland, O., will send Bulletin 100 at your request.

L-W CHUCKS AND DEMAGNETIZERS—L-W Chuck Co., Toledo, O., has brought together in one catalog, illustrations and descriptions of their magnetic chucks and demagnetizers, milling machine vises, dividing heads and high speed power saw. Dimension tables and other pertinent data are included. Ask for Catalog JW.

CLING SURFACE BELT TREATMENT—helps increase the output of your equipment by reviving drive belts. It permits belts to run slack under full loads, and may be applied while the belts are in operation. Cling-Surface Co., Dept. B-9, Buffalo, N. Y., has several bulletins available which further describe their product.

NEW HOMO TEMPERING CATALOG—Anyone concerned with the problem of war-speed tempering, annealing or stress-relieving of big loads should find of value the newly revised Catalog T-625, "Homo Method for Tempering," just issued by Leeds & Northrup Co., 4935 Stenton Ave., Philadelphia, Pa. New data, new charts, new pictures all show how the method is helping overcome heat treating bottlenecks in industry's battle of production. Send for your copy.

"TOOLS AND PARTS SALVAGE"—Thanks to the cooperation of America's leading manufacturers, Eutectic Welding Alloys, Inc., 41 Worth St., New York, N. Y., has been able to assemble a collection of unusual pictures of actual jobs which are amazing examples of what can be done in tool and machine parts salvage. Send for your copy of this folder.

(Continued on Page 184)

Gairing TOOLS

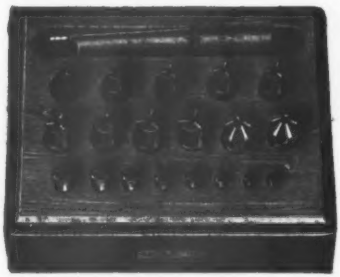
COUNTERBORE SETS

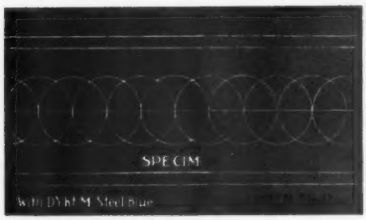
Today's war production program demands accurate, efficient cutting tools *within easy reach.* Gairing standard kits provide the answer for counterboring and spotfacing operations. Seven sets from which to choose. Each contains a logical assortment of *interchangeable* counterbores, pilots and holders boxed in sturdy cases.

THE GAIRING TOOL CO., Detroit, Michigan

For a quarter century specialists in fine cutting tools.

The set illustrated here consists of one Type A-1 holder, 9 cutters ranging from ¼" to ½", 8 pilots from $\frac{1}{32}$" to $\frac{3}{16}$", 2 countersinks ½" dia., 70° and 80°. *Write for catalog and prices.*





DYKEM STEEL BLUE *STOPS LOSSES* making dies & templates

Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information.

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COATINGS FOR DRAWING STAINLESS, LOW AND HIGH CARBON, AND COPPER COATED WIRE . . . . . ★

"Gilron" Coating Compounds increase drawing speed of stainless steel wire considerably. Multiple reductions can be drawn without recoating. Excellent results on welding wire. A better, brighter looking finish. No scratching. Longer die life.

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1557 East 40th Street
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A BIG VISE

FOR THE BIG JOBS

It's new—larger—heavier—accurate! Designed and built to fill the need for precision on the big vise jobs. Note the heavy jaws, longer ways, broad base and extra swivel bearing surface of this Rousselle Victory Vise. Once swivel is set, it stays put! Built to cut set-up time in half—made in four sizes: 4½ in., 7 in., 10 in. and 13 in.

Write for Bulletin TD-102 and prices.

Preference rating certificate must accompany orders.

Dealers: A few select territories still available.

DAVID J. ROSS CO.
BENTON HARBOR, MICH.

PUBLICATION PREVIEWS

(Continued from Page 82)

PANTOGRAPH ENGRAVING MACHINE—manufactured by New Hermes, Inc., 175 Fifth Ave., New York, N. Y., is the result of many years of experience in the engraving field. The machine is suited for production engraving on panels, indicator plates, plug sleeves, range-finder bands, scales and similar objects. Advantages, specifications and description of the Pantograph Engraving Machine are given in Bulletin A, now available.

KEEP 'EM CUTTING—The Campbell Model No. 425 Cutalator Abrasive Cutting Machine is described in a very interesting manner in a new booklet recently issued by Andrew C. Campbell Division of American Chain and Cable Co., Inc., Bridgeport, Conn. The booklet brings out, by means of clear, crisp line illustrations, the various features of the machine.

CHANNELLOCK PLIERS—which incorporate the new revolutionary, powerful gripping Channellock design in which the tongue and groove Channellock joint provides a vise-like grip entirely dependent of the gripping power of the user's hand, are described in a new bulletin. Address Champion DeArment Tool Co., Dept. DBH, Meadville, Pa.

THERMALLOY X-RAY INSPECTED CASTINGS—are treated in an attractive booklet issued by The Electro-Alloys Co., Dept. 2, Elyria, O. Profusely illustrated with actual shop application photographs, this booklet contains tables of grades and applications and physical properties of Thermalloy. Send for your copy.

LO-SWING LATHES—Catalog No. 42 was issued primarily for the busy tool room and die shopman. The line of Lo-Swing Lathes is well illustrated. The principal design features are treated and a table of Condensed Specifications for each machine make this Catalog a handy reference. Seneca Falls Machine Co., Dept. 7, Seneca Falls, N. Y., will send a copy.

HOSKINS ELECTRIC FURNACES—The different lines of electric furnaces and pyrometers manufactured by Hoskins Mfg. Co., Lawton Ave. and Buchanan St., Detroit, Mich., are attractively and profusely illustrated in Catalog No. 58-J. Important facts about Chromel units are given.

The book is divided into four sections—heat treating, laboratory, pyrometer and pyrometer accessories—and a handy index in the front of the book is a further aid to the busy tool room and die shop executive. Please address requests for Catalog 58-J on your company letterhead.

Hundreds of Users Prefer

Tru-Cut TOOL BITS

Where the

"GOING IS TOUGH"

Use Gold Tip and Blue Nose Bits on tough jobs like this and watch results.

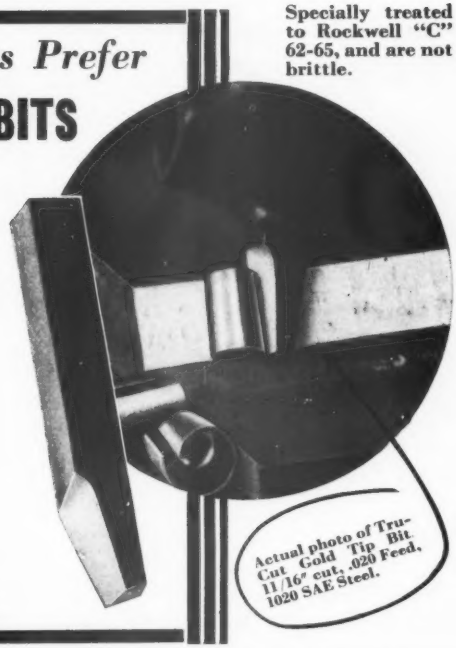
Center Drills . . . Keyway Cutters . . . Dovetails . . . Form Ground Tools

Send for Catalog and Prices

Tru-Cut TOOL COMPANY

14236 Birwood Detroit, Mich.

Specially treated to Rockwell "C" 62-65, and are not brittle.



Actual photo of Tru-Cut Gold Tip Bit. 11/16" cut, .020 Feed, 1020 SAE Steel.

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ARC WELDING

New Edition "Procedure Handbook of Arc Welding." Bigger than ever. Wider in scope. Latest information on all phases of arc welding—the ace process of war production and key to progress and increased earning power in post-war era.

Authoritative. Recognized the world over as the "bible" on arc welding design and practice. Many thousands in use by welders, designers, engineers and shop managers. Standard text in hundreds of schools and colleges.

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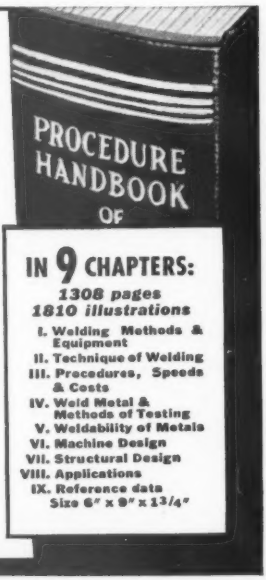
The TOOL & DIE Journal

2460 Fairmount Blvd. Cleveland, Ohio



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1308 pages
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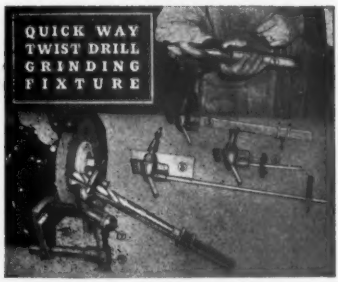
III. Procedures, Speeds & Costs
IV. Weld Metal & Methods of Testing
V. Weldability of Metals
VI. Machine Design
VII. Structural Design
VIII. Applications
IX. Reference data

Size 6" x 9" x 1 3/4"

NEW DRILL GRINDING FIXTURE



Built in three sizes, it includes everything necessary to grind any drill from a ¼" x 2⅞". Correct angles and clearances for all hard and soft metals are permanently built into the fixture. No adjustments need be made and the possibility of incorrect grinding is eliminated. One-half to ¾ time consumed by hand grinding is saved.

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Steel plus Service

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Closer tolerances
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Because: Wing key heat dissipation and absolute diamond lock nib.

● Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6' diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

Send specifications and prints for prices on turning and boring form tools.

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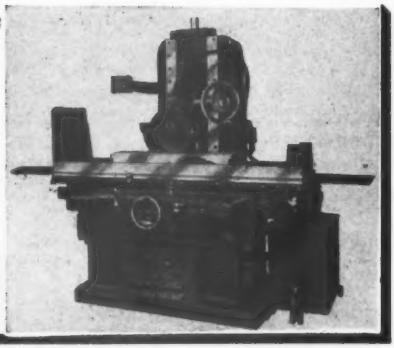
A one shot lubricating system insures long life and practically eliminates oiling time.

Bulletin GL-100 contains many shop application photographs. Send for your copy.



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304 Straight Ave., SW Grand Rapids, Mich.

Lacey

DIE SET MACHINE

No pry-bars or hammers necessary in separating punches from dies when you use this Lacey Die Set Machine. Easy to operate, it aligns punches to dies quickly and efficiently. The large handwheel which provides for sensitive, accurate lining up makes it possible for the tool maker to shear-in certain types of dies.

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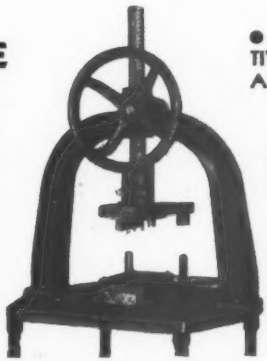
Prompt Delivery.



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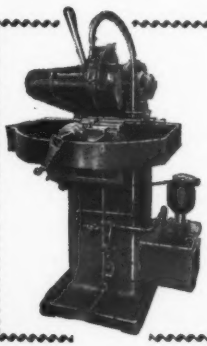

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For Rapid Cutting Of
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for IMMEDIATE Shipment

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FREE BISSETT CATALOG

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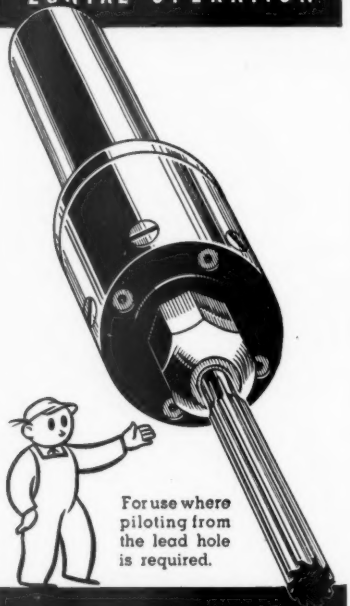
UNIVERSAL FLOATING CHUCKS FOR HORIZONTAL OPERATION



For use where piloting from the lead hole is required.

Designed for horizontal operation in automatic screw machines and turret lathes, Universal Floating Chucks are ideal for drilling, counterboring and reaming. Adjustable spring pressure compensates for tool weight thus preventing scored holes. Write for complete facts and prices.

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Engineering Company

Frankenmuth, Mich.

Inspectograph - Price, $35

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PROPER MAGNIFICATION
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SHADOWLESS FLUORESCENT
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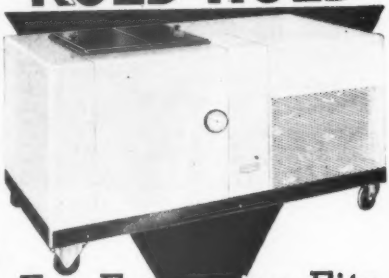

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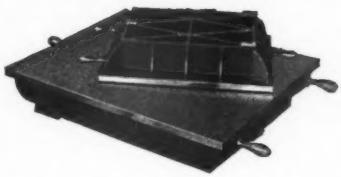

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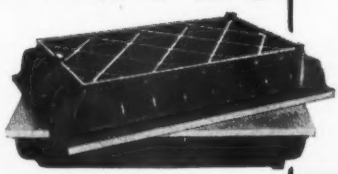

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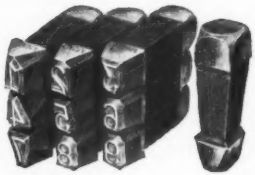

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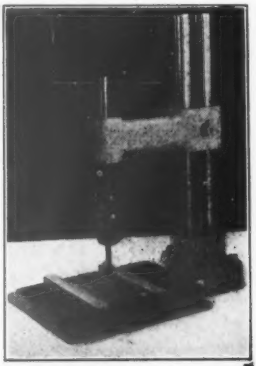

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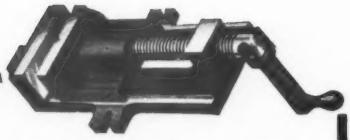

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This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes.

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	3½	12½
2D	5	5½	23

Do you need a vise of ANY type?

Write today for bulletins on the extensive Yost line

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Remove
BROKEN TAPS

Quickly
Insert WALTON Tap Extractor and back out broken piece. No annealing—no drilling.

Easily
Tap Extractor and Tap Wrench are only tools needed.

Safely
Threads are not damaged. Not necessary to tap oversize after broken tap is removed.

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Increased production results from direct, non-glaring VIMCOLIGHT illumination . . . as a necessary supplement to modern over-all fluorescent lighting.
Standard equipment on hundreds of America's finest machine tools . . . VIMCOLIGHT rates your consideration.

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LAY-OUT DYE
for SHARPLY DEFINED SCRIBED LINES
for TOOL, DIE, PATTERN, OR TEMPLATE LAYOUT ON METAL
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One Qt. $1.50 One Gal. $4.25
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The Inspectograph is adjustable, enabling the user to tilt the lens to any desired position. A large 4-inch lens provides undistorted 4-power magnification to both eyes, without squinting, thus exposing defects invisible to the naked eye.

Two fluorescent tubes concentrate a diffused light upon the work to be inspected, eliminating all outside glare and shadows.

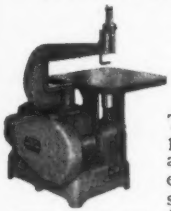
Address S. Lowe & Sons Co., Dept. LJ, Fairfield, Conn., for descriptive literature.

A Correction

THE copy in the Ajax Engineering & Mfg. Company's advertisement, which appeared on page 37 of our September issue, should have read: "Also 10 speeds 125 to 2900 R.P.M. available at extra cost," instead of "Also 10 speeds 125 to 2900 R.P.M. available at no extra cost."

MODEL NO. 16 "SPECIAL"

Constructed as per Specifications of U. S. Naval Aircraft Factories



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(Die Making Machine)

This is a very heavy, powerful machine and is designed for extra heavy filing and sawing, but it performs small work just as well. This type of machine is usually adopted in Ammunition Plants, Airplane Factories and machine shops where heavy and precision filing and sawing is desired. We also manufacture smaller models — Model D—10" table; Model No. E. L.—12" table.

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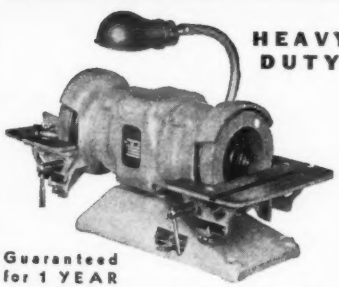
Special GRINDER for
CARBIDE TOOLS



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Other sizes made on order.

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Modern facilities for designing and building Precision Tools—Dies—Jigs—Fixtures—Molds—Gages—Special Machines—Precision Specialties. Also, shops equipped to provide Stampings—Forgings—Castings—Plastics—Grinding—and similar contract services.

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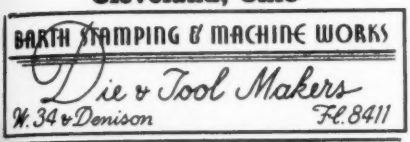

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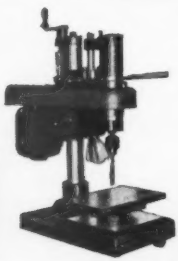
USE INSTEAD

The HAMILTON MUEHLMATT
Super Sensitive
DRILLING MACHINE



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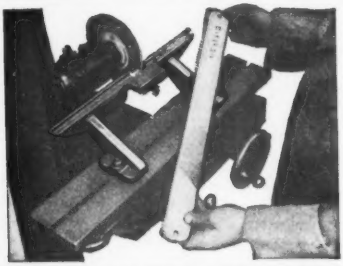
HAMILTON OHIO



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Many industrial concerns have solved this problem by regrinding their blades ten and more times.

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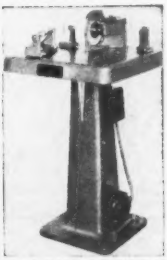

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(Continued from Page 205)

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— the only Tool Makers' Indicator on the market with Two Working Ends for inside and outside tests. Compression and balance torsion give accuracy to a tool of high magnifying power. Scale of indicator reads .001" and has 11 lines divided into ½" space. Shock proof. Attachments of the indicater broaden its use and fit any gauge on the market with ⅜" spindle. Dealers Wanted.

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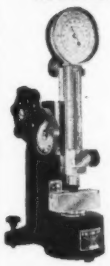

has been done with the
SCLEROSCOPE
since 1907

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TAMMS BLUE LAYOUT DOPE?
Speeds layout on all metals. Gives clean accurate detail. Won't chip, crack or flake off. Comes 8 oz. brush-in cans, also pts., qts., gals., drums.
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SCHAUER IDEAL Speed Lathes

IDEAL for POLISHING LAPPING FINISHING of small parts.

"the originators of today's Speed Lathes"

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MARKING SPECIALISTS

CAN SHOW YOU THE
QUICK

WAY TO MARK OFFENSE PARTS WITH NUMBERING, LETTERING AND DESIGN.

MARKING MACHINES, NUMBERING MACHINES, STEEL LETTERS & FIGURES CARRIED IN STOCK OR MADE TO ORDER.

Send Your Marking Problem and Ask for Catalog.

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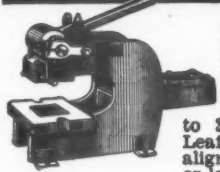
MOST CAPACITY
POSITIVE ALIGNMENT



Max. cap. 2" dia. hole thru 10 ga. iron, proper shear on punch, throat depth 6". Takes punch press dies up to 3" x 4½" in area. Leaf arm gives perfect alignment without ways or leader pins. Portable.

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Ask your dealer or write direct.

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2941 Carroll Ave. Chicago

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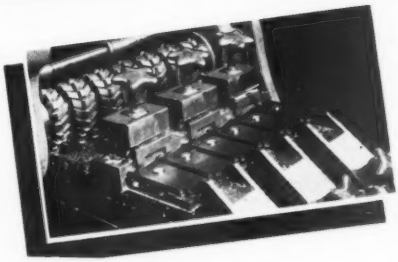

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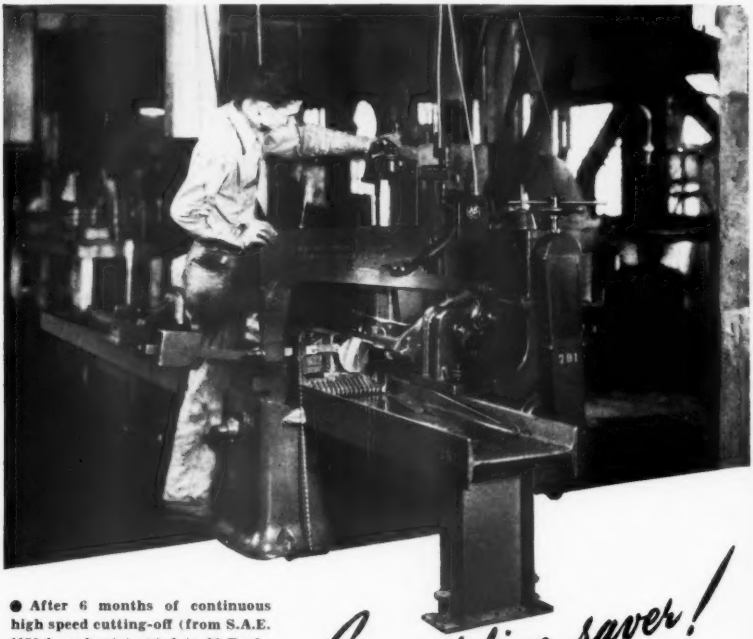

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